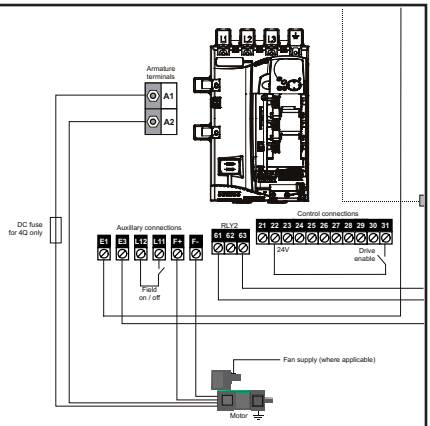
LEROY SOMER

4434 en - 2011.07 / c

This manual is to be given to the end user



MENTOR MP

Short form guide

General Information

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation or adjustment of the optional operating parameters of the equipment or from mismatching the variable speed drive with the motor.

The contents of this guide are believed to be correct at the time of printing. In the interests of a commitment to a policy of continuous development and improvement, the manufacturer reserves the right to change the specification of the product or its performance, or the contents of the guide, without notice.

All rights reserved. No parts of this guide may be reproduced or transmitted in any form or by any means, electrical or mechanical including photocopying, recording or by an information storage or retrieval system, without permission in writing from the publisher.

Drive software version

This product is supplied with the latest software version. If this drive is to be connected to an existing system or machine, all drive software versions should be verified to confirm the same functionality as drives of the same model already present. This may also apply to drives returned from LEROY-SOMER.

If there is any doubt please contact LEROY-SOMER.

The software version of the drive can be checked by looking at Pr **11.29** (**di14/0.49**) and Pr **11.34**. This takes the form of xx.yy.zz where Pr **11.29** (**di14/0.49**) displays xx.yy and Pr **11.34** displays zz. (e.g. for software version 01.01.00, Pr **11.29** (**di14/0.49**) = 1.01 and Pr **11.34** displays 0).

Environmental statement

LEROY-SOMER is committed to minimising the environmental impacts of its manufacturing operations and of its products throughout their life cycle. To this end, we operate an Environmental Management System (EMS) which is certified to the International Standard ISO 14001. Further information on the EMS, our Environmental Policy and other relevant information is available on request, or can be found at www.leroy-somer.com.

The electronic variable-speed drives manufactured by LEROY-SOMER have the potential to save energy and (through increased machine/process efficiency) reduce raw material consumption and scrap throughout their long working lifetime. In typical applications, these positive environmental effects far outweigh the negative impacts of product manufacture and end-of-life disposal.

Nevertheless, when the products eventually reach the end of their useful life, they must not be discarded but should instead be recycled by a specialist recycler of electronic equipment. Recyclers will find the products easy to dismantle into their major component parts for efficient recycling. Many parts snap together and can be separated without the use of tools, whilst other parts are secured with conventional fasteners. Virtually all parts of the product are suitable for recycling.

Product packaging is of good quality and can be re-used. Large products are packed in wooden crates, while smaller products come in strong cardboard cartons which themselves have a high recycled fibre content. If not re-used, these containers can be recycled. Polythene, used on the protective film and bags for wrapping product, can be recycled in the same way. LEROY-SOMER' packaging strategy prefers easily-recyclable materials of low environmental impact, and regular reviews identify opportunities for improvement.

When preparing to recycle or dispose of any product or packaging, please observe local legislation and best practice.

REACH legislation

EC Regulation 1907/2006 on the Registration, Evaluation, Authorisation and restriction of Chemicals (REACH) requires the supplier of an article to inform the recipient if it contains more than a specified proportion of any substance which is considered by the European Chemicals Agency (ECHA) to be a Substance of Very High Concern (SVHC) and is therefore listed by them as a candidate for compulsory authorisation.

For current information on how this requirement applies in relation to specific LEROY-SOMER products, please approach your usual contact in the first instance.

Issue Number: 4

Software: 01.05.01 onwards

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Note

1 Safety Information

1.1 Warnings, Cautions and Notes

A **Warning** contains information, which is essential for avoiding a safety hazard.

A **Caution** contains information, which is necessary for avoiding a risk of damage to the product or other equipment.

NOTE A **Note** contains information which helps to ensure correct operation of the product.

1.2 Electrical safety - general warning

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive.

Specific warnings are given at the relevant places in this Guide.

1.3 System design and safety of personnel

The drive is intended as a component for professional incorporation into complete equipment or system. If installed incorrectly, the drive may present a safety hazard.

The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury.

System design, installation, commissioning / start-up and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and this guide carefully.

The STOP and START controls or electrical inputs of the drive must not be relied upon to ensure safety of personnel. They do not isolate dangerous voltages from the output of the drive or from any external option unit. The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

The drive is not intended to be used for safety-related functions.

Careful consideration must be given to the function of the drive which might result in a hazard, either through its intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk - for example, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

1.4 Environmental limits

Instructions within the supplied data and information within the *Mentor MP User Guide* regarding transport, storage, installation and the use of the drive must be complied with, including the specified environmental limits. Drives must not be subjected to excessive physical force.

1.5 Access

Access must be restricted to authorized personnel only. Safety regulations which apply at the place of use must be complied with.

1.6 Fire protection

The drive enclosure is not classified as a fire enclosure. A separate fire enclosure must be provided.

1.7 Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses and other protection, and protective ground (earth) connections.

The *Mentor MP User Guide* contains instructions for achieving compliance with specific EMC standards.

Within the European Union, all machinery in which this product is used must comply with the following directives:

2006/42/EC: Safety of machinery

2004/108/EC: Electromagnetic compatibility

1.8 Motor

Ensure the motor is installed in accordance with the manufacturer's recommendations. Ensure the motor shaft is not exposed.

Low speeds may cause the motor to overheat because the cooling fan becomes less effective. The motor should be installed with a protection thermistor. If necessary, an electric forced ventilation fan should be used.

The values of the motor parameters set in the drive affect the protection of the motor. The default values in the drive should not be relied upon.

It is essential that the correct value is entered into Pr **5.07** (**SE07, 0.28**), *Motor rated current.* This affects the thermal protection of the motor.

1.9 Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

1.10 Electrical installation

1.10.1 Electric shock risk

The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC supply cables and connections
- Output cables and connections
- Many internal parts of the drive, and external option units

Unless otherwise indicated, control terminals are single insulated and must not be touched.

1.10.2 Stored charge

The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

2 Product information

2.1 Introduction

The *Mentor MP Short Form Guide* is designed as a concise aid to drive installation and operation. More information, including the *Mentor MP User Guide* and *Mentor MP Advanced User Guide*, can be found on the CD supplied with the drive.

Table 2-1 Model to frame size cross reference

Model			Frame
480V EN/IEC cULus	**575V EN/IEC cULus to 600V**	**690V EN/IEC**	
MP25A4(R)	MP25A5(R)		1A
MP45A4(R)	MP45A5(R)		
MP75A4(R)	MP75A5(R)		
MP105A4(R)	MP105A5(R)		1B
MP155A4(R)	MP155A5(R)		
MP210A4(R)	MP210A5(R)		
MP350A4(R)	MP350A5(R)	MP350A6(R)	2A
MP420A4(R)			
	MP470A5(R)	MP470A6(R)	
MP550A4(R)			
MP700A4(R)	MP700A5(R)	MP700A6(R)	2B
MP825A4(R)	MP825A5(R)	MP825A6(R)	
MP900A4(R)			
MP1200A4	MP1200A5	MP1200A6	2C
MP1850A4	MP1850A5	MP1850A6	
MP1200A4R	MP1200A5R	MP1200A6R	2D
MP1850A4R	MP1850A5R	MP1850A6R	

2.2 Current ratings

The power ratings for the 480V, 575V and 690V configurations are shown in Table 2-2, Table 2-3 and Table 2-4.

The continuous current ratings given are for a maximum ambient temperature of 40°C (104°F) and an altitude of 1000m. For operation at higher temperatures and altitudes de-rating is required. Overload of 150% for 30s is available with ambient temperature of 40°C (104°F) up to a maximum of 10 repetitions per hour. For further information refer to the *Mentor MP User Guide*.

Table 2-2 480V current ratings

Model	AC input current	DC output current		Typical motor power	
	Continuous	Continuous	150% overload	@ 400Vdc	@ 500Vdc
	A	A	A	kW	hp
MP25A4(R)	22	25	37.5	9	15
MP45A4(R)	40	45	67.5	15	27
MP75A4(R)	67	75	112.5	27	45
MP105A4(R)	94	105	157.5	37.5	60
MP155A4(R)	139	155	232.5	56	90
MP210A4(R)	188	210	315	75	125
MP350A4(R)	313	350	525	125	200
MP420A4(R)	376	420	630	150	250
MP550A4(R)	492	550	825	200	300
MP700A4(R)	626	700	1050	250	400
MP825A4(R)	738	825	1237.5	300	500
MP900A4(R)	805	900	1350	340	550
MP1200A4(R)	1073	1200	1800	450	750
MP1850A4(R)	1655	1850	2775	700	1150

Table 2-3 575V current ratings

Model	AC input current	DC output current		Typical motor power (With Vdc = 630V)	
	Continuous	Continuous	150% overload		
	A	A	A	kW	hp
MP25A5(R)	22	25	37.5	14	18
MP45A5(R)	40	45	67.5	25	33
MP75A5(R)	67	75	112.5	42	56
MP105A5(R)	94	105	157.5	58	78
MP155A5(R)	139	155	232.5	88	115
MP210A5(R)	188	210	315	120	160
MP350A5(R)	313	350	525	195	260
MP470A5(R)	420	470*	705	265	355
MP700A5(R)	626	700	1050	395	530
MP825A5(R)	738	825*	1237.5	465	620
MP1200A5(R)	1073	1200	1800	680	910
MP1850A5(R)	1655	1850	2775	1045	1400

*For this rating at 575V, 150% overload time is 20s at 40°C and 30s at 35°C.

Table 2-4 690V current ratings

Model	AC input current	DC output Current		Typical motor power (With Vdc = 760V)	
	Continuous	Continuous	150% Overload		
	A	A	A	kW	hp
MP350A6(R)	313	350	525	240	320
MP470A6(R)	420	470*	705	320	425
MP700A6(R)	626	700	1050	480	640
MP825A6(R)	738	825*	1237.5	650	850
MP1200A6(R)	1073	1200	1800	850	1150
MP1850A6(R)	1655	1850	2775	1300	1750

* For this rating at 690V, 150% overload time is 20s at 40°C and 30s at 35°C.

Maximum continuous input current

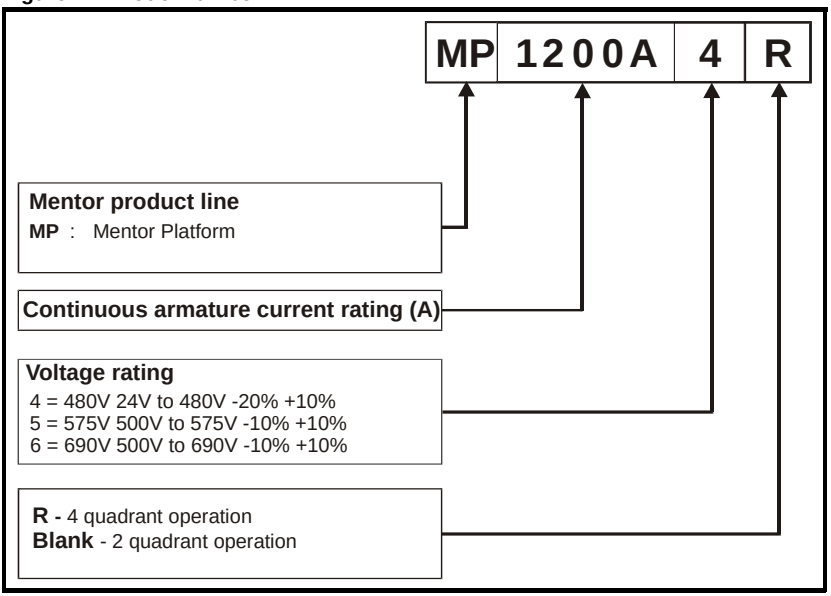
The values of maximum continuous input current are given to aid the selection of cables and fuses. These values are stated for worst-case condition.

NOTE For current ratings above 1850A then parallel connection of the drives is required. However, this function is not implemented on firmware versions V01.05.01 and earlier.

2.3 Model number

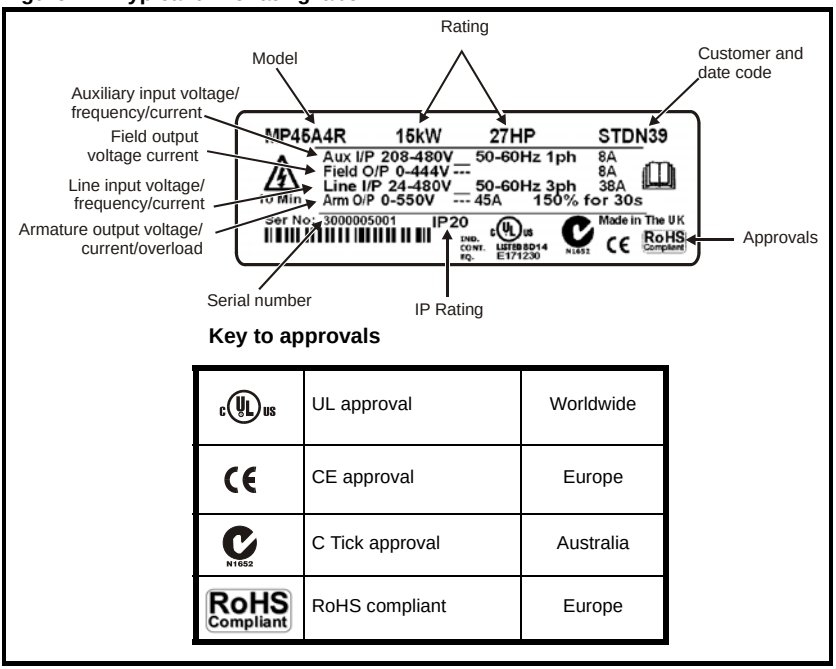
The way in which the model numbers for the Mentor MP range are formed is described in Figure 2-1.

Figure 2-1 Model number


MP 1200A 4 R
Mentor product line
MP : Mentor Platform
Continuous armature current rating (A)
Voltage rating
4 = 480V 24V to 480V -20% +10%
5 = 575V 500V to 575V -10% +10%
6 = 690V 500V to 690V -10% +10%
R - 4 quadrant operation
Blank - 2 quadrant operation

2.4 Nameplate description

Figure 2-2 Typical drive rating label



Key to approvals

c UL us	UL approval	Worldwide
CE	CE approval	Europe
N1652	C Tick approval	Australia
RoHS Compliant	RoHS compliant	Europe

2.4.1 Output current

The continuous output current ratings given on the rating label are for maximum 40°C (104°F) and 1000m altitude. Derating is required for higher ambient temperatures >40°C (104°F) and higher altitude. For derating information, refer to the *Mentor MP User Guide* on the CD supplied with the drive.

2.4.2 Input current

The input current is affected by the supply voltage, frequency and load inductance. The input current given on the rating label is the typical input current.

2.5 Drive features and options

Figure 2-3 Drive features and options on size 1

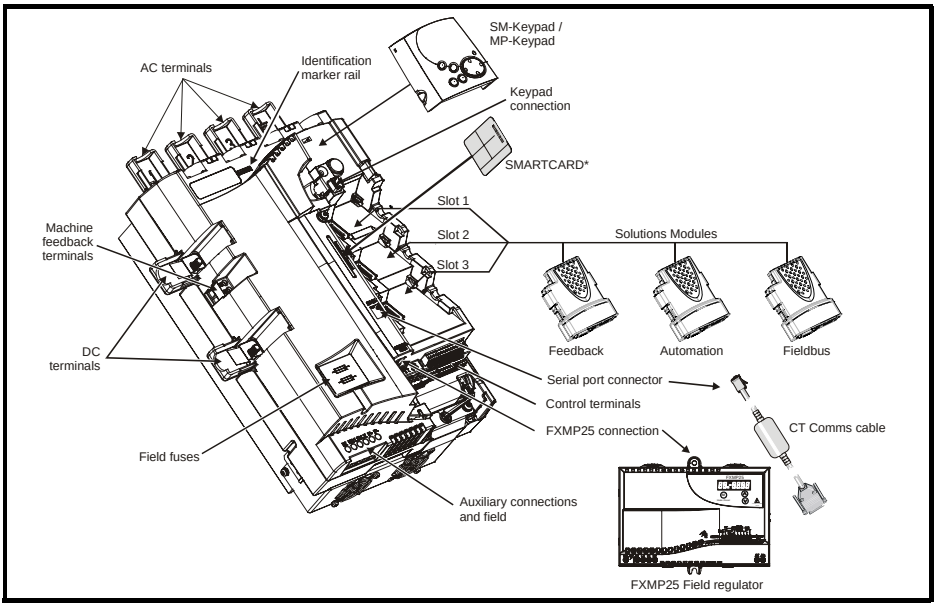
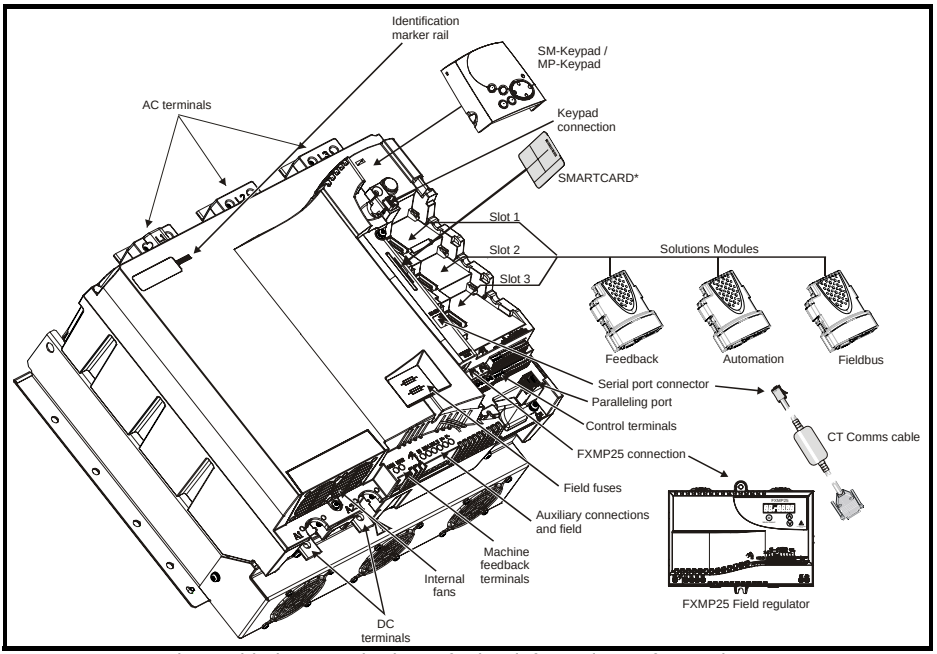


Figure 2-4 Drive features and options on size 2



* A SMARTCARD is provided as standard. For further information, refer to Chapter 7 *SMARTCARD operation* on page 74.

2.5.1 Options available for Mentor MP

All Solutions Modules are color-coded in order to make identification easy. The following table shows the color-code key and gives further details on their function.

Table 2-5 Solutions Module identification

Type	Solutions Module	Color	Name	Further Details
Feedback		Light Green	SM-Universal Encoder Plus	**Universal Feedback interface** Feedback interface for the following devices: **Inputs** • Incremental encoders • SinCos encoders • SSI encoders • EnDat encoders **Outputs** • Quadrature • Frequency and direction • SSI simulated outputs
		Brown	SM-Encoder Plus	**Incremental encoder interface** Feedback interface for incremental encoders without commutation signals. No simulated encoder outputs available
		Dark Brown	SM-Encoder Output Plus	**Incremental encoder interface** Feedback interface for incremental encoders without commutation signals. Simulated encoder output for quadrature, frequency and direction signals
		N/A	15-way D-type converter	**Drive encoder input converter** Provides screw terminal interface for encoder wiring and spade terminal for shield
		N/A	Single ended encoder interface (15V or 24V)	**Single ended encoder interface** Provides an interface for single ended ABZ encoder signals, such as those from hall effect sensors. 15V and 24V versions are available.

Table 2-5 Solutions Module identification

Type	Solutions Module	Color	Name	Further Details
Automation (I/O Expansion)		Yellow	SM-I/O Plus	**Extended I/O interface** Increases the I/O capability by adding the following to the existing I/O in the drive: • Digital inputs x 3 • Digital I/O x 3 • Analog inputs (voltage) x 2 • Analog output (voltage) x 1 • Relay x 2
		Yellow	SM-I/O 32	**Extended I/O interface** Increase the I/O capability by adding the following to the existing I/O in the drive: • High speed digital I/O x 32 • +24V output
		Dark Yellow	SM-I/O Lite	**Additional I/O** 1 x Analog input (± 10V bi-polar or current modes) 1 x Analog output (0 to 10V or current modes) 3 x Digital input and 1 x Relay
		Dark Red	SM-I/O Timer	**Additional I/O with real time clock** As per SM-I/O Lite but with the addition of a Real Time Clock for scheduling drive running
		Turquoise	SM-I/O PELV	**Isolated I/O to NAMUR NE37 specifications** For chemical industry applications 1 x Analog input (current modes) 2 x Analog outputs (current modes) 4 x Digital input / outputs, 1 x Digital input, 2 x Relay outputs
		Olive	SM-I/O 120V	**Additional I/O conforming to IEC 61131-2 120Vac** 6 digital inputs and 2 relay outputs rated for 120Vac operation
		Cobalt Blue	SM-I/O 24V Protected	**Additional I/O with overvoltage protection up to 48V** 2 x Analog outputs (current modes) 4 x Digital input / outputs, 3 x Digital inputs, 2 x Relay outputs
Automation (Applications)		Moss Green	SM-Applications Plus	**Applications Processor (with CTNet)** 2nd processor for running pre-defined and /or customer created application software with CTNet support. Enhanced performance over SM-Applications
		White	SM-Applications Lite V2	**Applications Processor** 2nd processor for running pre-defined and /or customer created application software. Enhanced performance over SM-Applications Lite
		Green brown	SM-Register	**Applications Processor** 2nd processor for running position capture functionality with CTNet support.

Table 2-5 Solutions Module identification

Type	Solutions Module	Color	Name	Further Details
Fieldbus		Purple	SM-PROFIBUS DP-V1	**Profibus option** PROFIBUS DP adapter for communications with the drive
		Medium Grey	SM-DeviceNet	**DeviceNet option** Devicenet adapter for communications with the drive
		Dark Grey	SM-INTERBUS	**Interbus option** Interbus adapter for communications with the drive
		Light Grey	SM-CANopen	**CANopen option** CANopen adapter for communications with the drive
		Beige	SM-Ethernet	**Ethernet option** 10 base-T / 100 base-T; Supports web pages, SMTP mail and multiple protocols: DHCP IP addressing; Standard RJ45 connection
		Brown Red	SM-EtherCAT	**EtherCAT option** EtherCAT adapter for communications with the drive

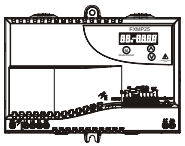
Table 2-6 Keypad identification

Keypad	Name	Further Details
	SM-Keypad	**LED keypad option** Keypad with a LED display
	MP-Keypad	**LCD keypad option** Keypad with an alpha-numeric LCD display with Help function

Table 2-7 Serial comms lead

Serial comms lead	Name	Further Details
	CT Comms cable	CT EIA (RS) -232 (4500-0087) CT USB (4500-0096)

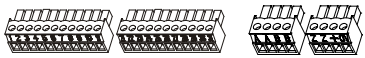
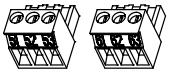
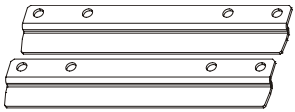
Table 2-8 External field control

External field controller	Name	Further Details
	FXMP25	For external control of field windings up to 25A, with field reversal capability. For further information, please see the *FXMP25 User Guide*.

2.6 Items supplied with the drive

The drive is supplied with a printed manual, a SMARTCARD, a safety information booklet, the Certificate of Quality, an accessory kit box including the items shown in Table 2-9, and a CD ROM containing all related product documentation and software tools.

Table 2-9 Parts supplied with the drive

Description	Size 1	Size 2A / 2B	Size 2C / 2D
Control connectors			
Tacho connector			
Relay connectors			
UL warning label			
UL warning label for heatsink temperature			
Grounding bracket			
Terminal cover grommets			
Terminal shrouds			
Terminal shroud base covers			
M4 Screws			
Mounting feet brackets			

3 Mechanical installation

3.1 Safety

Follow the instructions

The mechanical and electrical installation instructions must be adhered to. Any questions or doubt should be referred to the supplier of the equipment. It is the responsibility of the owner or user to ensure that the installation of the drive and any external option unit, and the way in which they are operated and maintained, comply with the requirements of the Health and Safety at Work Act in the United Kingdom or applicable legislation and regulations and codes of practice in the country in which the equipment is used.

Competence of the installer

The drive must be installed by professional assemblers who are familiar with the requirements for safety and EMC. The assembler is responsible for ensuring that the end product or system complies with all the relevant laws in the country where it is to be used.

If the drive has been used at high load levels for a period of time, the heatsink can reach temperatures in excess of 70°C (158°F). Human contact with the heatsink should be prevented.

Enclosure

The drive is intended to be mounted in an enclosure which prevents access except by trained and authorized personnel, and which prevents the ingress of contamination. It is designed for use in an environment classified as pollution degree 2 in accordance with IEC 60664-1. This means that only dry, non-conducting contamination is acceptable.

The drive enclosure is not classified as a fire enclosure. A separate fire enclosure must be provided.

Many of the drives in this product range weigh in excess of 15kg (33lb). Use appropriate safeguards when lifting these models.
A full list of drive weights can be found in the *Mentor MP User Guide*.

IP rating

It is the installer's responsibility to ensure that any enclosure which allows access to drives from model sizes 2A to 2D while the product is energized, provides protection against contact and ingress to the requirements of IP20.

Refer to section 12 of the *Mentor MP User Guide* for further details.

3.2 Terminal cover removal

WARNING

Isolation device
The AC supply must be disconnected from the drive using an approved isolation device before any cover is removed from the drive or before any servicing work is performed.

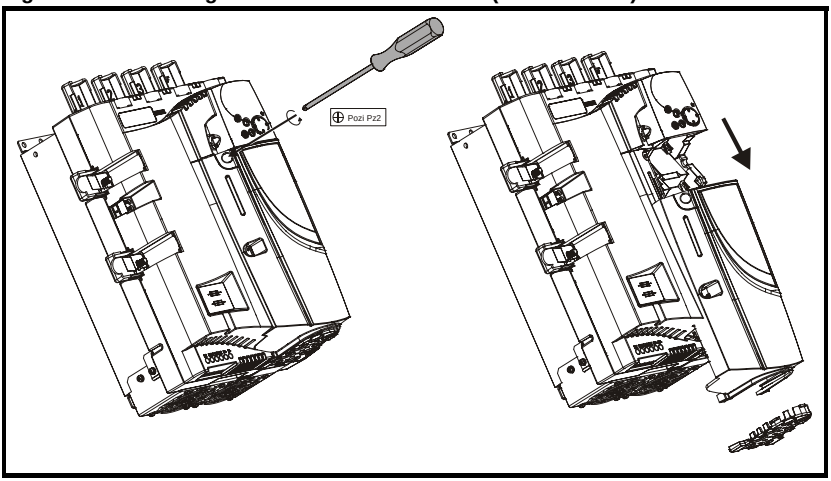
WARNING

Stored charge
The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

3.2.1 Removing the terminal covers

The drive is installed with one control terminal cover.

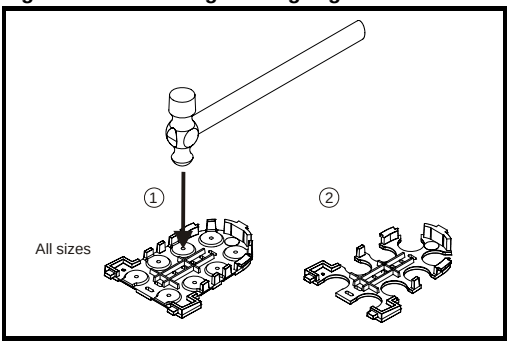
Figure 3-1 Removing the control terminal cover (size 1 shown)



To remove the terminal cover, undo the screw and slide the terminal cover downwards. When replacing the terminal covers the screw should be tightened with a maximum torque of 1 Nm (0.7 lb ft).

3.2.2 Removing the finger-guard and break-outs

Figure 3-2 Removing the finger-guard break-outs

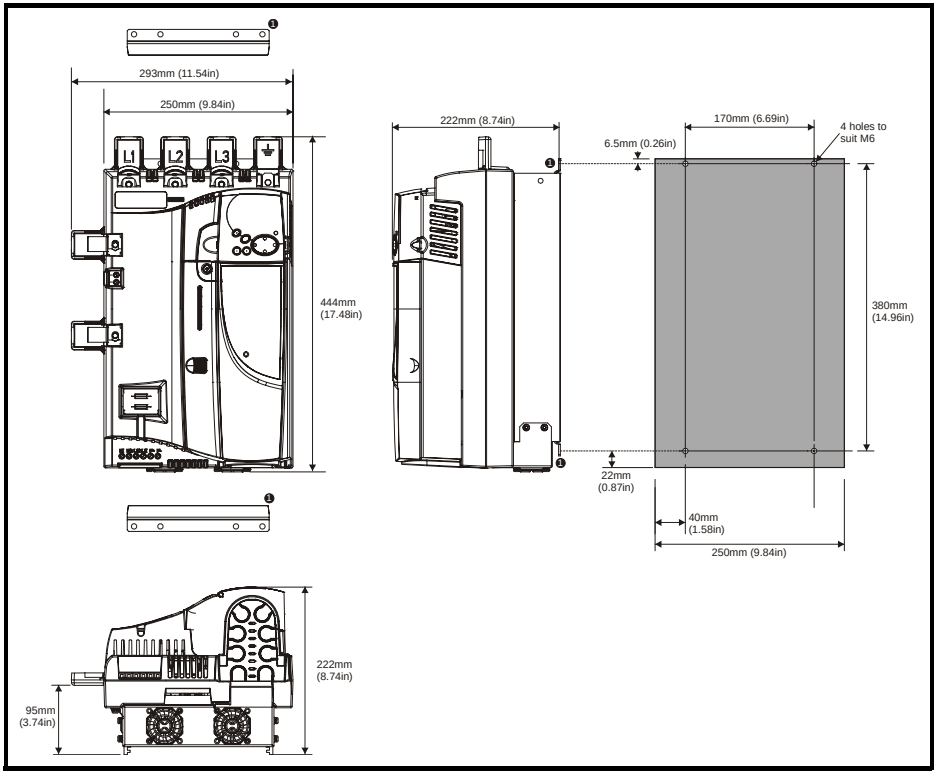


Place finger-guard on a flat solid surface and hit relevant break-outs with hammer as shown (1). Continue until all required break-outs are removed (2). Remove any flash / sharp edges once the break-outs are removed.

3.3 Mounting method

The Mentor MP can only be surface mounted.

Figure 3-3 Overall size 1A dimensions



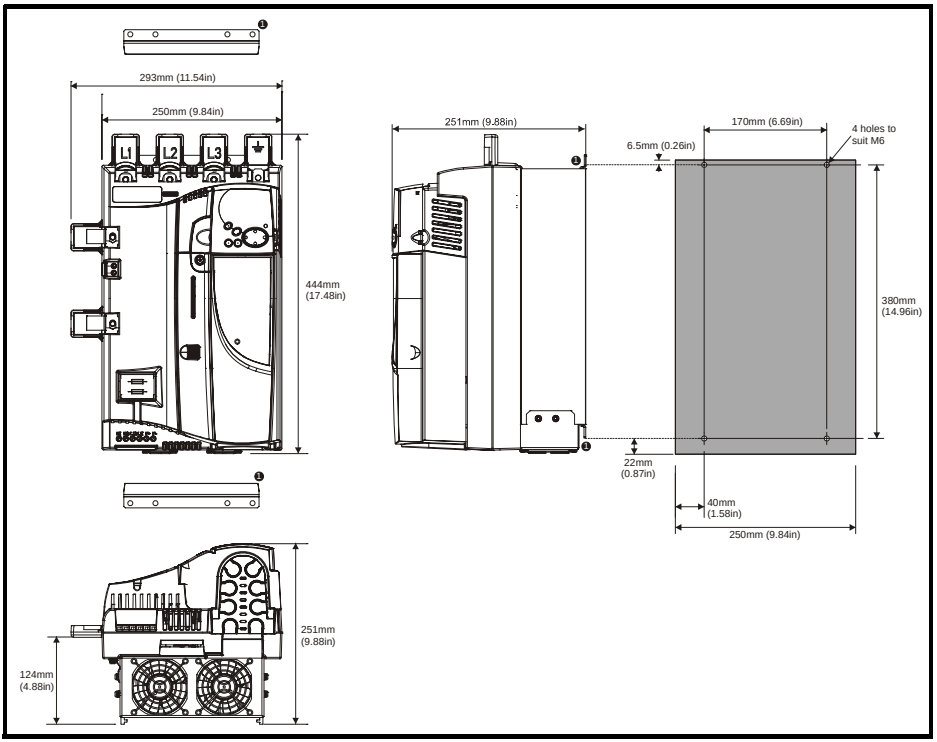
1. The two outer holes must be used for mounting the Mentor MP.

NOTE With the SMARTCARD installed to the drive, the depth measurement increases by 7.6mm (0.30 in).

NOTE Fans are only installed to the MP75A4(R) and MP75A5(R)

.

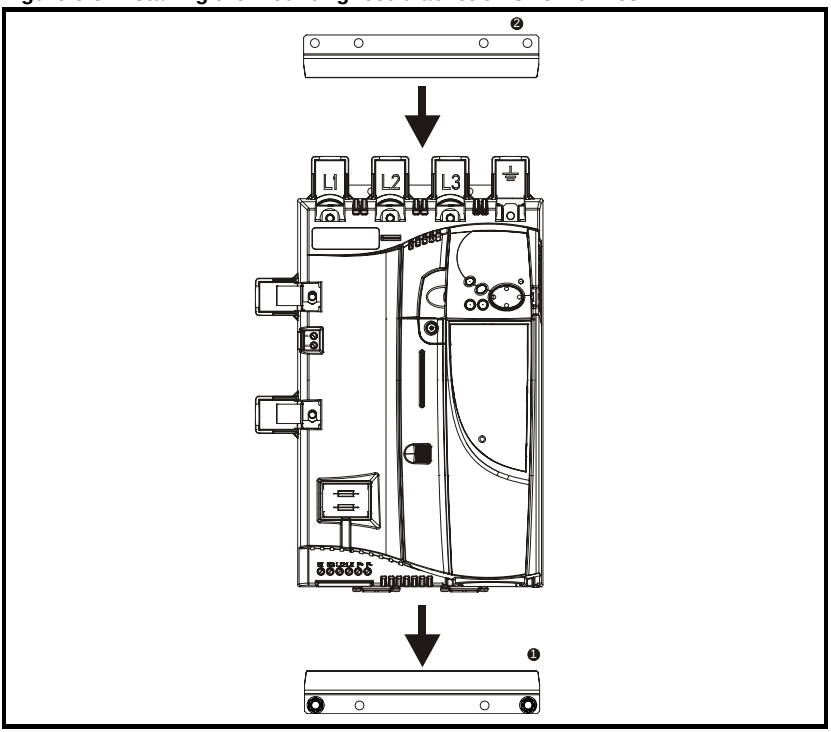
Figure 3-4 Overall size 1B dimensions



1. The two outer holes must be used for mounting the Mentor MP.

NOTE With the SMARTCARD installed to the drive, the depth measurement increases by 7.6mm (0.30 in).

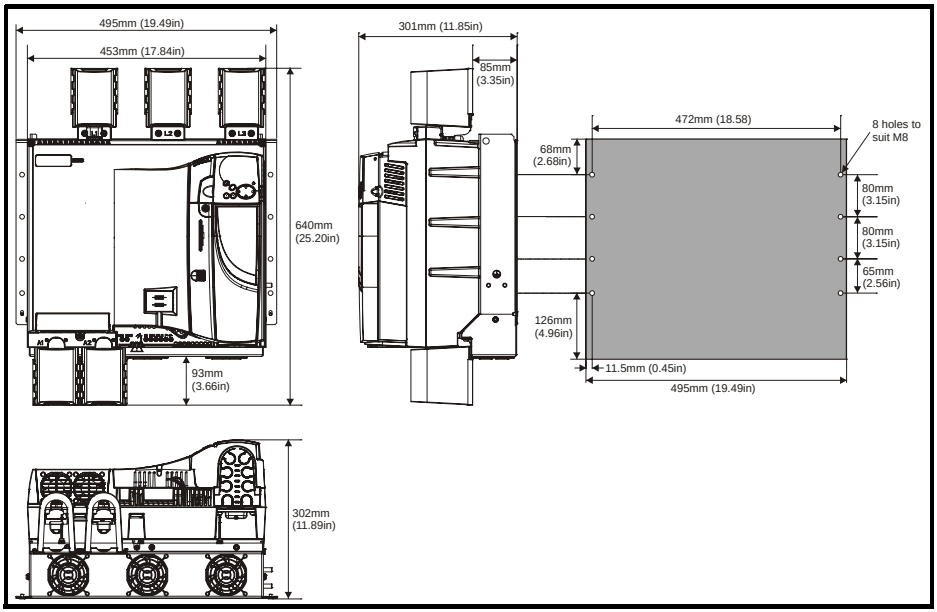
Figure 3-5 Installing the mounting feet bracket on size 1 drives



The bottom mounting bracket (1) should be installed to the back plate first with the screws fully tightened. The drive should then be lowered onto the bracket and slotted in. The top mounting bracket (2) should then be slotted into the drive and the top holes marked for mounting (380mm [14.96 in] from the centre of the holes on the bottom mounting bracket). Once the holes have been drilled, fix the top mounting bracket accordingly and tighten the screws.

It is not necessary to tighten the bottom mounting brackets with the drive in place. The brackets are designed to clamp the drive heatsink against the back plate

Figure 3-6 Overall size 2A / 2B dimensions



NOTE With the SMARTCARD installed to the drive, the depth measurement increases by 7.6mm (0.30 in).

Figure 3-7 Size 2C front view and mounting dimensions

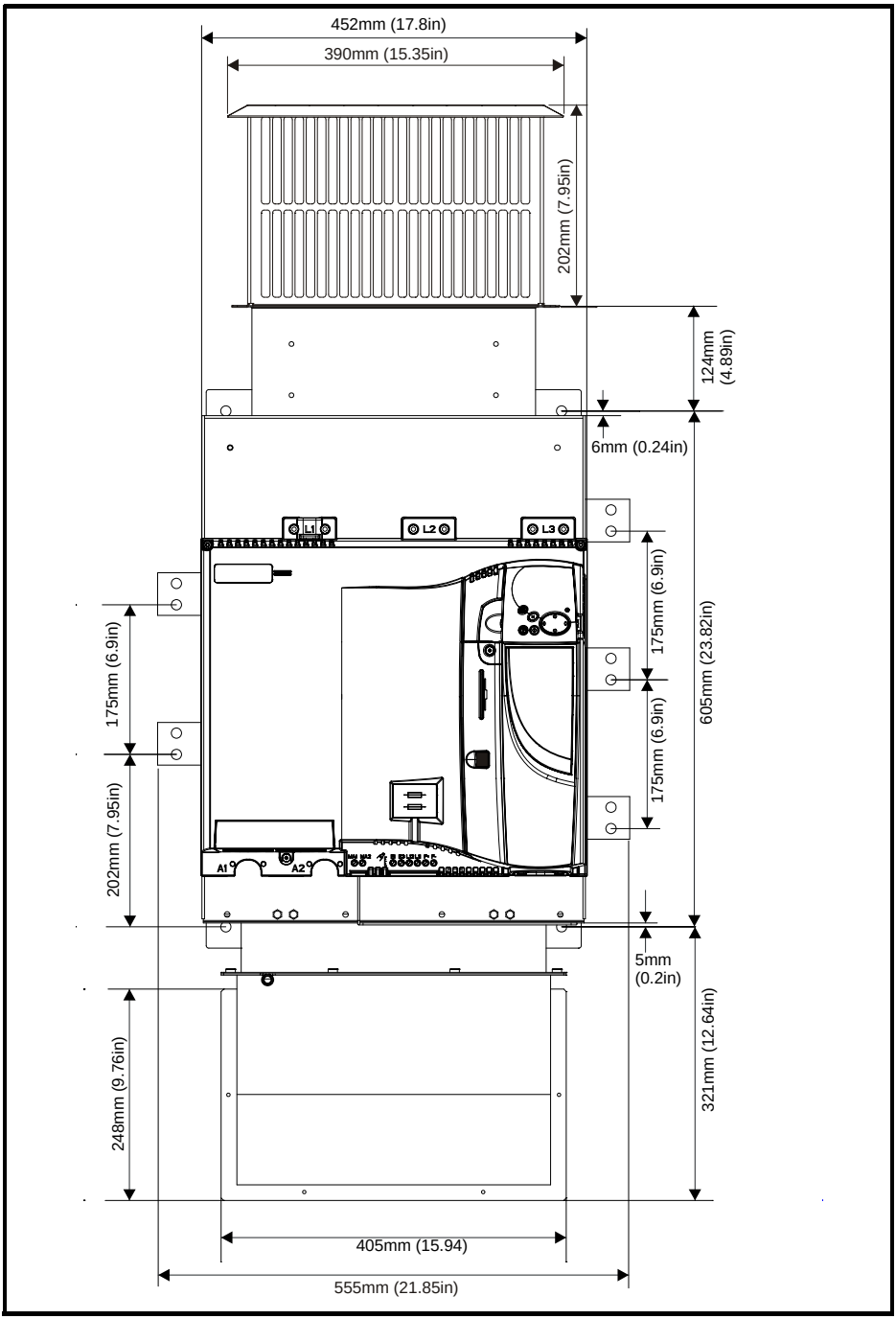
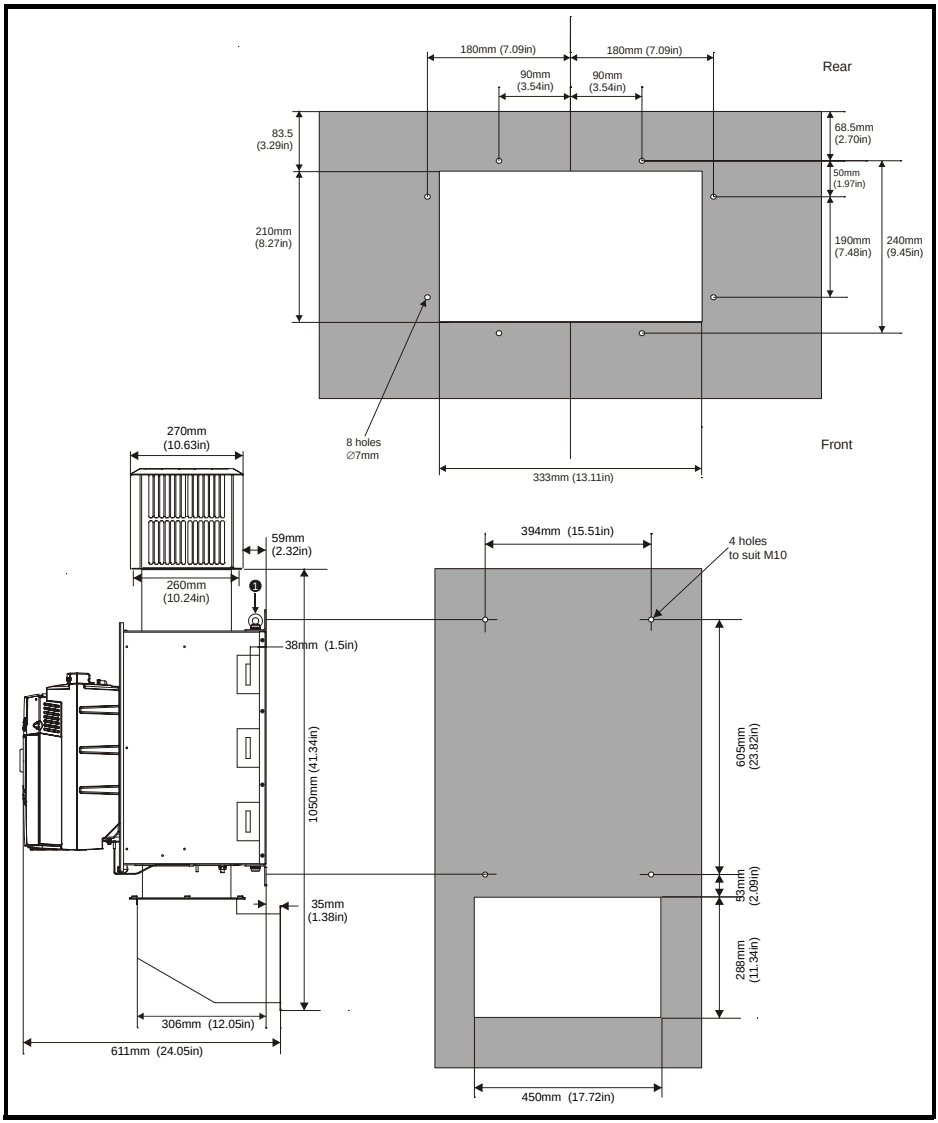


Figure 3-8 Size 2C back-plate and mounting detail



NOTE 1. M10 eye-bolts can be inserted in the location shown for lifting the drive. These are not supplied with the drive.

NOTE With the SMARTCARD installed to the drive, the depth measurement increases by 7.6mm (0.30 in).

Figure 3-9 Size 2D front view and mounting dimensions

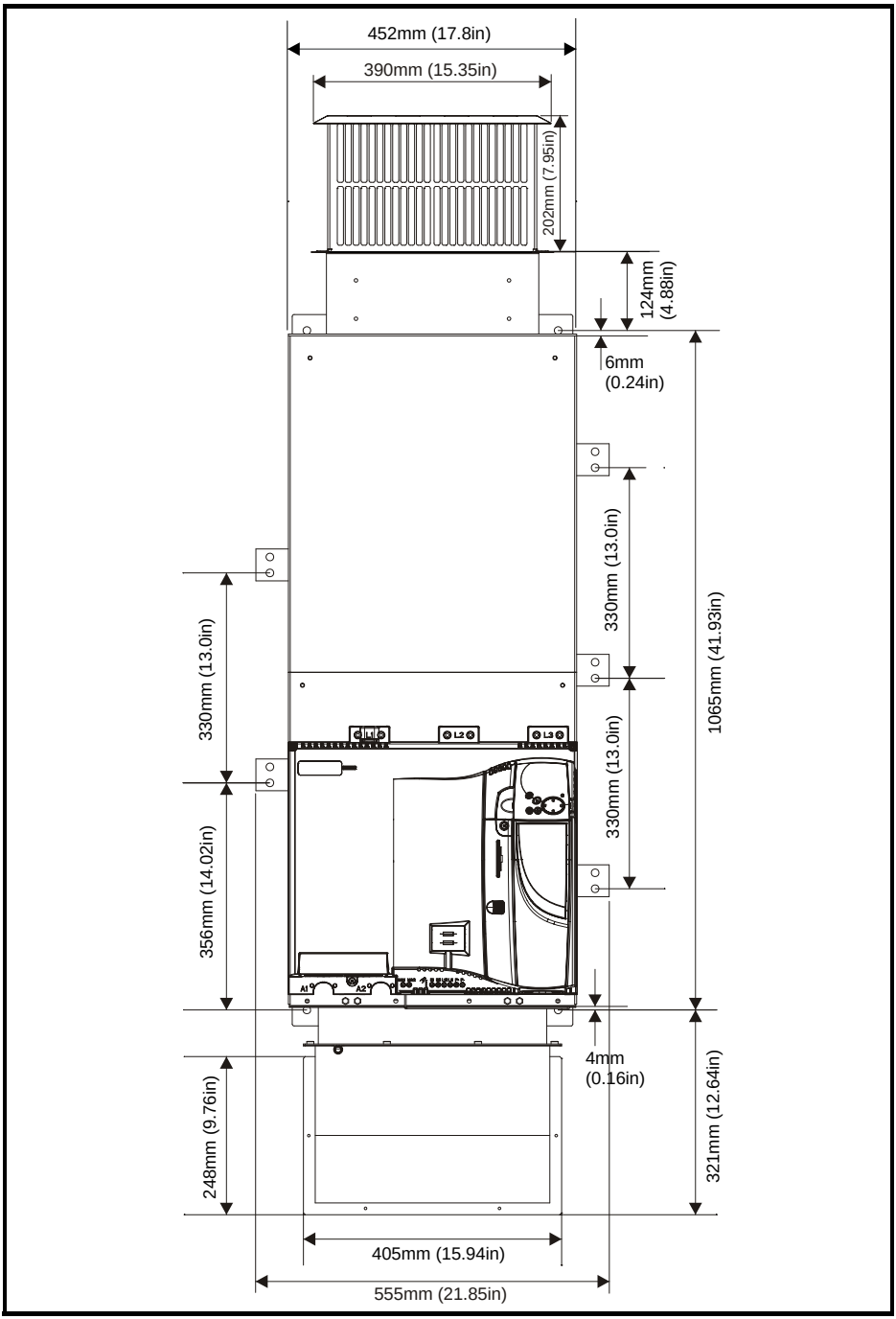
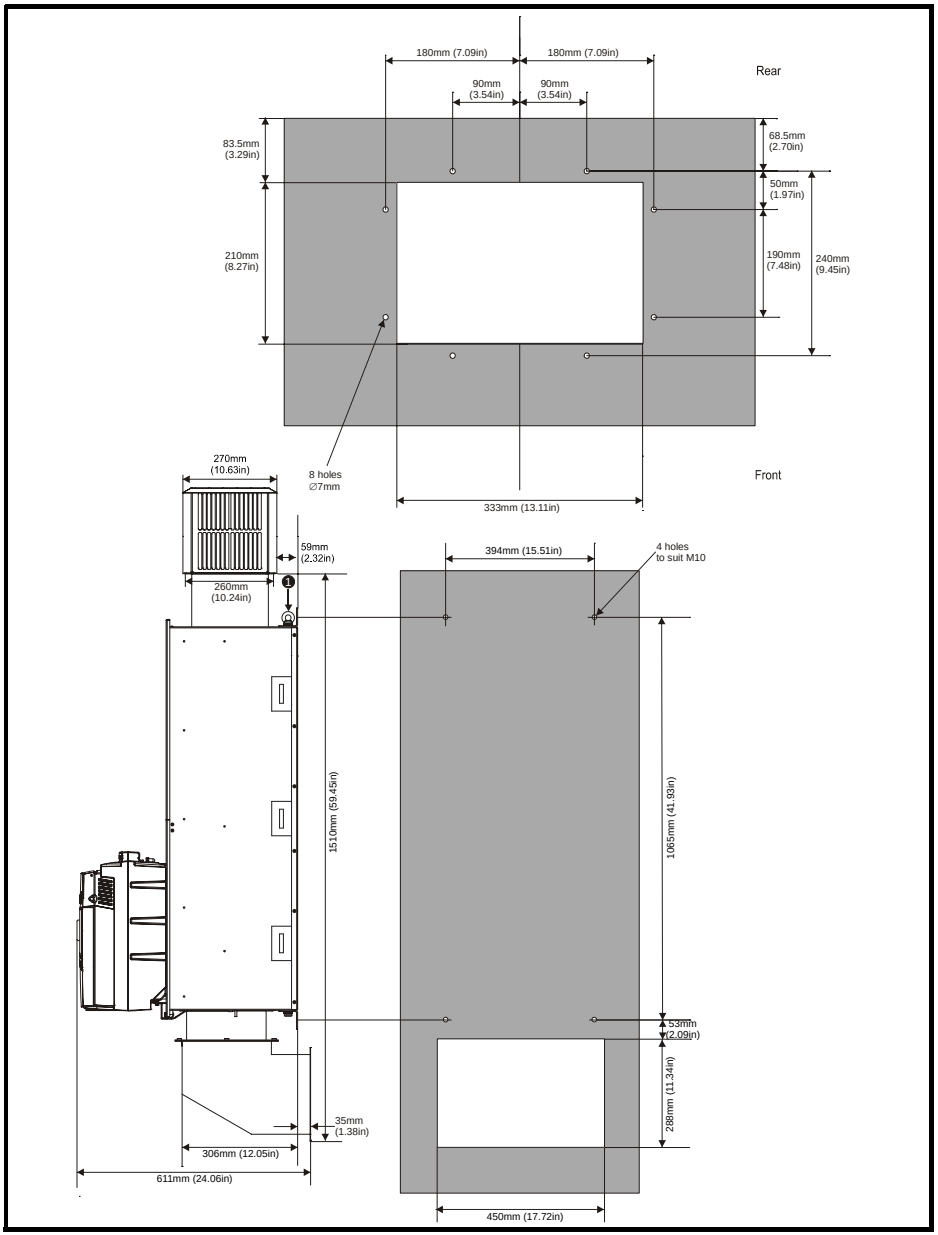


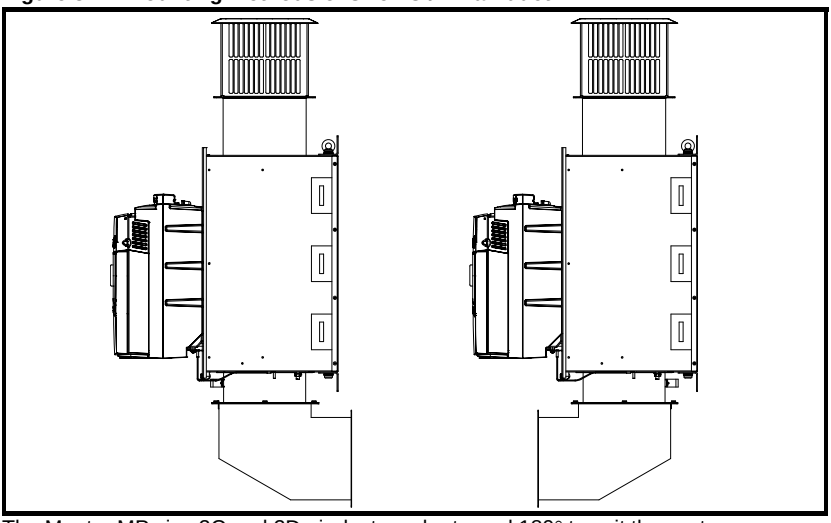
Figure 3-10 Size 2D back-plate and mounting detail



NOTE 1. M10 eye-bolts can be inserted in the location shown for lifting the drive. These are not supplied with the drive.

NOTE With the SMARTCARD installed to the drive, the depth measurement increases by 7.6mm (0.30 in).

Figure 3-11 Mounting methods of size 2C / 2D air duct

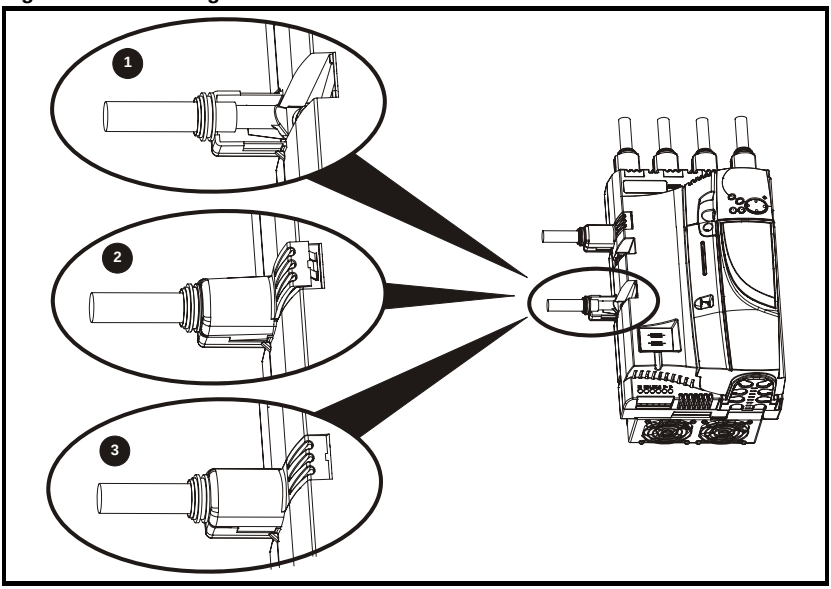


The Mentor MP size 2C and 2D air duct can be turned 180° to suit the customers infrastructure.

NOTE There is no seal provided with this product for sealing off the gap around the air duct when mounted.

3.4 Installing and removing the terminal shrouds

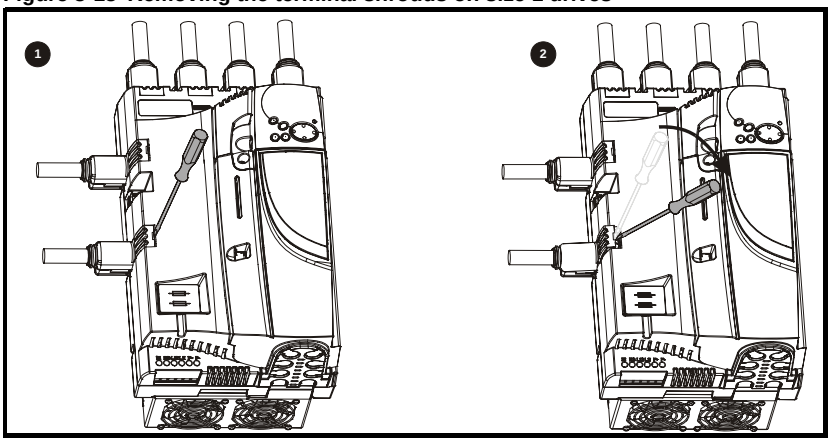
Figure 3-12 Installing the terminal shrouds on size 1 drives



1. Thread the AC supply and DC output connectors through the grommets provided and connect them to the drive.

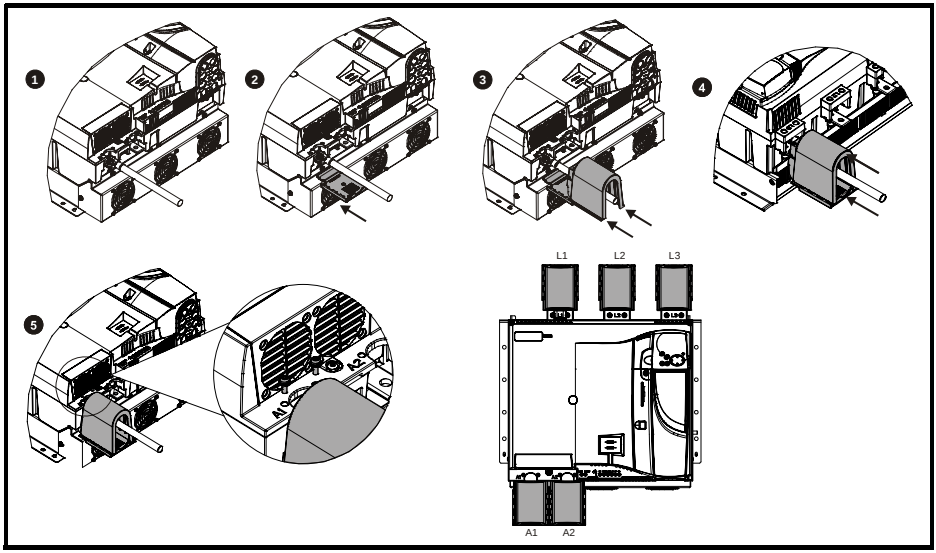
2. Place the terminal shroud over the top of the connectors and click into place (3).

Figure 3-13 Removing the terminal shrouds on size 1 drives



1. Insert the screwdriver as shown.
2. Lever in the direction shown to unclip the terminal shroud and remove.

Figure 3-14 Installing the terminal shrouds on size 2 drives



1. Assemble the cable to the busbar.
2. Place the terminal shroud base cover underneath the cable in the orientation shown.
3. Place the terminal shroud over the cable in the orientation shown, slide the terminal shroud on to the base cover in the direction shown until it clicks in to place.
4. For all power connections slide in the terminal shroud sub-assembly in the direction as shown.
5. Insert the 2 x M4 x 16 screws using a pozi drive screwdriver.

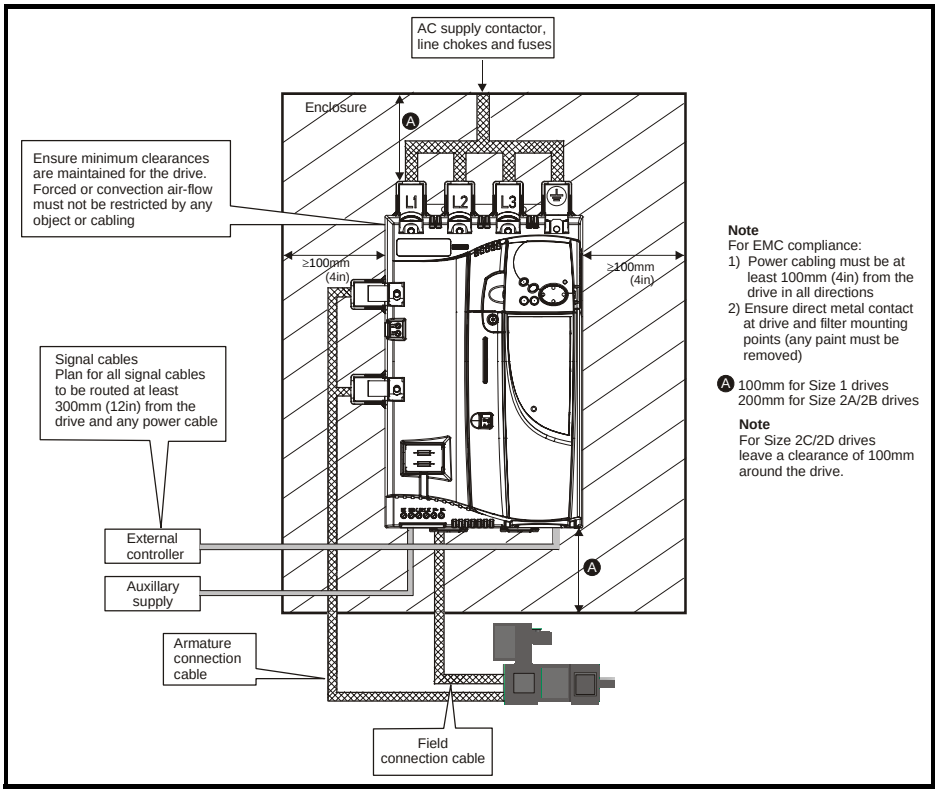
NOTE To remove the terminal shrouds, please reverse the process above.

3.5 Enclosure

Enclosure layout

Please observe the clearances in the diagram below taking into account any appropriate notes for other devices / auxiliary equipment when planning the installation.

Figure 3-15 Enclosure layout


AC supply contactor, line chokes and fuses
Enclosure
A
Ensure minimum clearances are maintained for the drive. Forced or convection air-flow must not be restricted by any object or cabling
L1
L2
L3
≥100mm (4in)
≥100mm (4in)
Signal cables
Plan for all signal cables to be routed at least 300mm (12in) from the drive and any power cable
External controller
Auxillary supply
Armature connection cable
Field connection cable
Note
For EMC compliance:
1) Power cabling must be at least 100mm (4in) from the drive in all directions
2) Ensure direct metal contact at drive and filter mounting points (any paint must be removed)
A 100mm for Size 1 drives
200mm for Size 2A/2B drives
Note
For Size 2C/2D drives leave a clearance of 100mm around the drive.

4 Electrical installation

Electric shock risk
The voltages present in the following locations can cause severe electric shock and may be lethal:

- AC supply cables and connections.
- DC cables, and connections.
- Many internal parts of the drive, and external option units.

Unless otherwise indicated, control terminals are single insulated and must not be touched.

Isolation device
The AC supply must be disconnected from the drive using an approved isolation device before any cover is removed from the drive or before any servicing work is performed.

STOP function
The STOP function does not remove dangerous voltages from the drive, the motor or any external option units.

Drives are suitable for use on supplies of installation category III and lower, according to IEC 60664-1. This means they may be connected permanently to the supply at its origin in a building, but for outdoor installation additional over-voltage suppression (transient voltage surge suppression) must be provided to reduce category IV to category III.

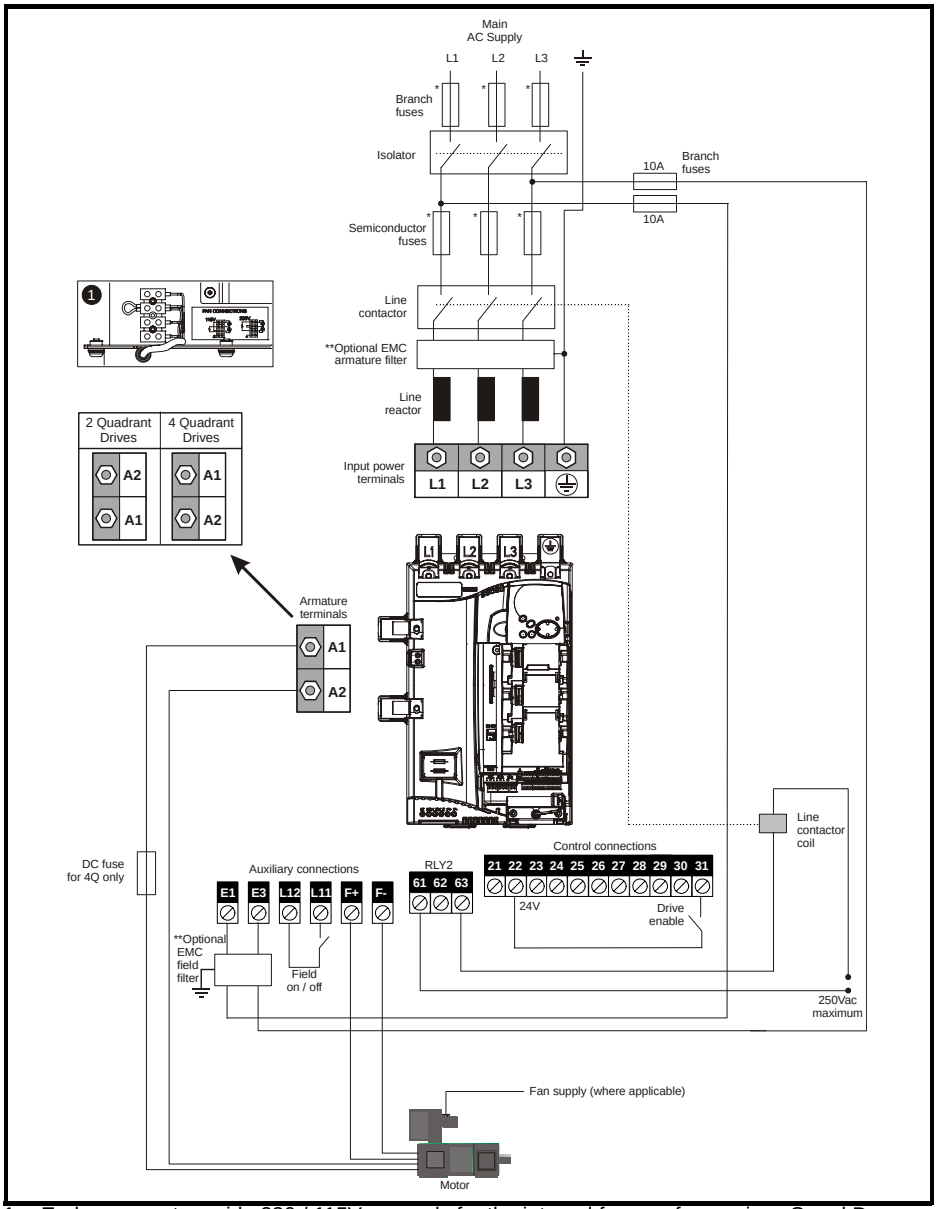
NOTE For details on the MOV ground (earth) disconnect, refer to the *Mentor MP User Guide.*

NOTE For details on the external suppressor resistor connections, refer to the *Mentor MP User Guide.*

4.1 Electrical connections

Refer to Figure 4-1 to understand the function of the different power connections.

Figure 4-1 Power connections for 480V drive



1. End user must provide 230 / 115Vac supply for the internal fans on frame sizes C and D, see section 4.8 on page 49.

* For fuse ratings refer to section 4.6 *Cable and fuse size ratings* on page 38.

**For further information on EMC filters, please refer to the *Mentor MP User Guide*.

4.1.1 Use of residual current device (RCD)

There are three common types of ELCB / RCD:

1. AC - detects AC fault currents
2. A - detects AC and pulsating DC fault currents (provided the DC current reaches zero at least once every half cycle)
3. B - detects AC, pulsating DC and smooth DC fault currents
   - Types A and AC should never be used with Mentor MP drives.
   - Type B must be used with all Mentor MP drives.

WARNING

Only type B ELCB (Earth leakage circuit braker) / RCD are suitable for use with Mentor MP drives.

If an external EMC filter is used, a delay of at least 50ms should be incorporated to ensure spurious trips are not seen. The leakage current is likely to exceed the trip level if all of the phases are not energized simultaneously.

4.2 Ground connection

The drive must be connected to the system ground of the AC supply. The ground wiring must conform to local regulations and codes of practice.

WARNING

Where there is a possibility of temporary condensation or corrosion occurring, the ground connection should be protected from corrosion by suitable jointing compound.

WARNING

Ground loop impedance

The ground loop impedance must conform to the requirements of local safety regulations. The drive must be grounded by a connection capable of carrying the prospective fault current until the protective device (fuse, etc,) disconnects the AC supply. The ground connections must be inspected and tested at appropriate intervals.

Figure 4-2 Location of ground connection on size 1 drives

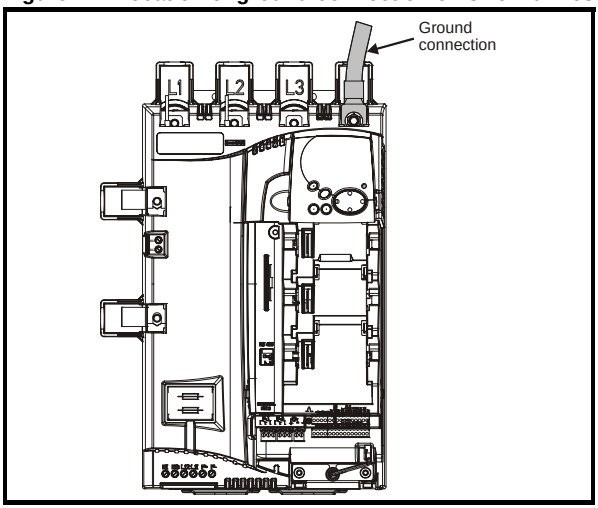


Figure 4-3 Location of ground connections on size 2A / 2B drives

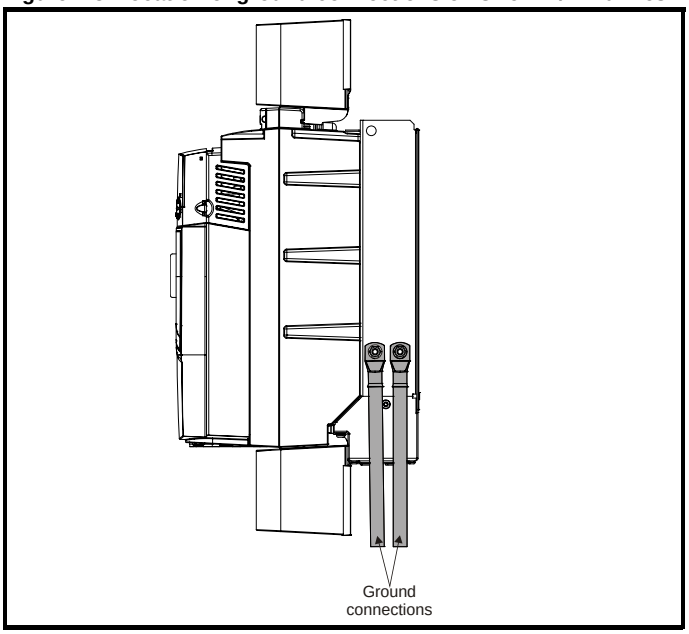
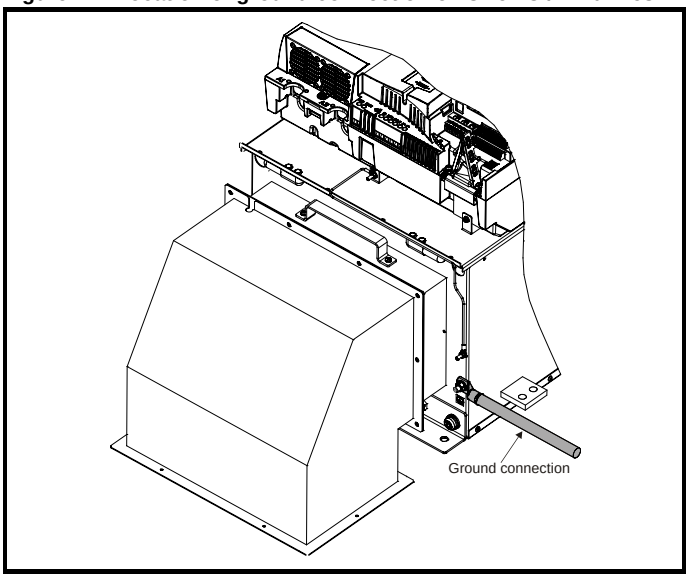


Figure 4-4 Location of ground connection on size 2C / 2D drives



4.3 AC supply requirements

The standard drive is rated for a nominal supply voltage up to 480Vrms.

An optional rating of 575Vrms is available for size 1 drives.

An optional rating of 575Vrms and 690Vrms is available for size 2 drives.

WARNING

Grounded delta supplies exceeding 575V are not permitted for drives rated up to and including 210A. Grounded delta supplies exceeding 600V are not permitted for drives rated 350A and above.

4.3.1 Supply types

Drives rated for supply voltages up to 575V (rated up to 210A) and 600V (350A and above) are suitable for use with any supply type, i.e. TN-S, TN-C-S, TT, IT, with grounding at any potential, i.e. neutral, centre or corner ("Grounded-delta").

Grounded delta supplies >575V are not permitted for drives rated up to and including 210A. Grounded delta supplies >600V are not permitted for drives rated 350A and above.

4.3.2 Supply fault current

The maximum fault current level of the supply to all circuits is 100kA subject to the capability of the semiconductor fuse fitted.

4.3.3 Main AC supply (L1, L2, L3)

Table 4-1 Three phase AC supply

Specification	Product voltage variant		
	480V	**575V**	**690V**
Maximum nominal supply	480V	575V	690V
Tolerance	+10%		
Minimum nominal supply	24V	500V	
Tolerance	-20%	-10%	

4.4 Line reactors

The Mentor MP, in common with all naturally commutated thyristor drives, causes voltage notches at the input supply terminals. In order to avoid disturbance to other equipment using the same supply, the addition of external line inductance is strongly recommended in order to restrict the depth of the notches imposed on the shared supply. This is generally not necessary where a dedicated transformer is used to supply the drive.

The following recommendations for added line inductance, have been calculated based on the power drive systems standard: EN 61800-3:2004 “Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods”.

NOTE The current ratings specified in Table 4-2 are for typical motor currents where the motor current ripple is no more than 50% of drive rating.

Table 4-2 Minimum required line inductance for a typical application (50% ripple content)

Drive rated current	System voltage				Typical current rating	Maximum current rating
	400V	480V	575V	690V		
A	µH	µH	µH	µH	A	A
25	220	260	320		21	22
45	220	260	320		38	40
75	220	260	320		63	67
105	220	260	320		88	94
155	160	190	230		130	139
210	120	140	170		176	188
350	71	85	110	120	293	313
420	59	71			351	375
470			80	91	393	420
550	45	54			460	492
700	36	43	53	61	586	626
825			45	52	690	738
900	28	33			753	805
1200	21	25	31	36	1004	1073
1850	18	23	29	32	1548	1655

NOTE

1. The above assumes the supply has 1.5% impedance.
2. Assumes a minimum supply rating of 5kA and a maximum rating of 60kA.

4.4.1 Auxiliary AC supply and connections

Table 4-3 Terminal functions

Terminals	Function
E1, E3	Supply for control electronics and field controller.
L11, L12	Field on / off. When L11 and L12 are open the supply is disconnected to the field regulator so there will be no field current.
F+, F-	Field supply to the motor.
MA1, MA2	Refer to the *Mentor MP User Guide*

Table 4-4 Line to line supply

Specification	Value
Maximum nominal supply	480V
Tolerance	+10%
Minimum nominal supply	208V
Tolerance	-10%

Each drive has an onboard field controller with the following current ratings.

Table 4-5 Current ratings

Model			Maximum auxiliary supply input current A	Maximum continuous field current rating A
MP25A4(R)	MP25A5(R)		13	8
MP45A4(R)	MP45A5(R)			
MP75A4(R)	MP75A5(R)			
MP105A4(R)	MP105A5(R)			
MP155A4(R)	MP155A5(R)			
MP210A4(R)	MP210A5(R)			
MP350A4(R)	MP350A5(R)	MP350A6(R)	23	20
MP420A4(R)				
	MP470A5(R)	MP470A6(R)		
MP550A4(R)				
MP700A4(R)	MP700A5(R)	MP700A6(R)		
MP825A4(R)	MP825A5(R)	MP825A6(R)		
MP900A4(R)				
MP1200A4	MP1200A5	MP1200A6		
MP1850A4	MP1850A5	MP1850A6		
MP1200A4R	MP1200A5R	MP1200A6R		
MP1850A4R	MP1850A5R	MP1850A6R		

4.4.2 Supply requirements

Maximum supply in-balance: 2% negative phase sequence (equivalent to 3% voltage in-balance between phases)

Frequency range: 48 to 65 Hz (maximum rate of frequency change is 7Hz/s)

4.5 Control 24Vdc supply

The 24Vdc input has three main functions.

- It can be used to supplement the drive's own internal 24V when multiple SM-Universal Encoder Plus, SM-Encoder Output Plus, SM-I/O Plus, or SM-I/O 32 modules are being used and the current drawn by these modules is greater than the drive can supply. (If too much current is drawn from the drive, the drive will initiate a 'PS.24V' trip)
- It can be used as a back-up power supply to keep the control circuits of the drive powered up when the line power supply is removed. This allows any fieldbus modules, application modules, encoders or serial communications to continue to operate.
- It can be used to commission the drive when the line power supply is not available, as the display operates correctly. However, the drive will be in the UV trip state unless the line power supply is enabled, therefore diagnostics may not be possible (Power down save parameters are not saved when using the 24V back-up power supply input).

The working voltage range of the 24V power supply is as follows:

Maximum continuous operating voltage:	30.0V
Minimum continuous operating voltage:	19.2V
Nominal operating voltage:	24.0V

Minimum start up voltage:	21.6V
Maximum power supply requirement at 24V:	60W
Recommended fuse:	3 A, 50Vdc

Minimum and maximum voltage values include ripple and noise. Ripple and noise values must not exceed 5%.

4.6 Cable and fuse size ratings

The selection of the correct fuse is essential to ensure the safety of the installation

Maximum continuous input currents are given in section 2.2 *Current ratings* on page 9 to aid the selection of fuses and cabling. The maximum input current is dependent on the ripple content of the output current. A value of 100% ripple has been assumed for the given ratings.

The cable sizing selected when installing a Mentor MP must comply with the local wiring regulations. The information provided in this section is provided for guidance purposes only.

The power terminals on Mentor MP frame size 1 drives have been designed to accommodate a maximum cable size of 150mm^2 (350kcmil) with a temperature of 90°C (194°F).

The power terminals on Mentor MP frame size 2A drives have been designed to accommodate a maximum cable size of 2 x 150mm^2 (2 x 350kcmil) with a temperature of 75°C (167°F).

The power terminals on Mentor MP frame size 2B drives have been designed to accommodate 2 x 240mm^2 with a temperature of 90°C (194°F). The use of cables sized using the US national electrical code as shown in Table 4-8 requires the use of a terminal adaptor.

The power terminals on Mentor MP frame size 2C and 2D drives have been designed for use with busbars. The drive can be used with cables as shown in Table 4-8 with the use of a terminal adaptor.

The actual cable size depends on a number of factors including:

- Actual maximum continuous current
- Ambient temperature
- Cable support, method and grouping
- Cable voltage drop

In applications where the motor used is of a reduced rating, the cable sizing selected can be appropriate for that motor. To protect the motor and the output cabling the drive must be programmed with the correct motor rated current.

NOTE When using reduced cable sizes, the branch circuit protection fuse rating needs to be reduced in line with the cable size selected.

The following table shows typical cable sizes based on USA and International standards, assuming 3 conductors per raceway/conduit, an ambient temperature of 40°C (104°F) and applications with high output current ripple content.

Table 4-6 Typical cable sizes for size 1 drives

Model		IEC 60364-5-52[1]		UL508C/NEC[2]	
		Input	Output	Input	Output
MP25A4(R)	MP25A5(R)	2.5mm^2	4mm^2	8 AWG	8 AWG
MP45A4(R)	MP45A5(R)	10mm^2	10mm^2	4 AWG	4 AWG
MP75A4(R)	MP75A5(R)	16mm^2	25mm^2	1 AWG	1/0 AWG
MP105A4(R)	MP105A5(R)	25mm^2	35mm^2	1/0 AWG	1/0 AWG
MP155A4(R)	MP155A5(R)	50mm^2	70mm^2	3/0 AWG	4/0 AWG
MP210A4(R)	MP210A5(R)	95mm^2	95mm^2	300kcmil	350kcmil

NOTE

1. The maximum cable size is defined by the power terminal housing using 90°C (194°F) rated cables as per Table A.52-5 of the standard.
2. Assumes the use of 75°C (167°F) rated cables, as per Table 310.16 of the National Electrical Code.

The use of higher temperature rated cable would allow a reduction on the minimum recommended cable size for Mentor MP shown above. For high temperature cable sizing, please refer to the data supplied by the manufacturer of the high temperature cable.

Table 4-7 Auxiliary wiring for size 1 drives

Frame size	Maximum input current	Continuous output current	IEC 60364-5-52 Table A52-4 Column B2		UL 508C	
			Column B2 derated by 0,87 of PVC at 40			
			E1, E3 size	F+, F- , L11 & L12 size	E1, E3 size	F+, F- , L11 & L12 size
	A	A	mm²	mm²	mm²	mm²
1	13	8	2.5	1.5	14 AWG	14 AWG

Notes for IEC 60364:
IEC 60364-5-52 use installation method B2, table A.52-4 for three loaded conductors, PVC insulation 30°C and apply derating factor for 40°C from table A.52-14 (0.87 for PVC).

Notes for UL508C:
Either 60°C or 75°C cable can be used. Ampacities as per table 40.3 as described in the UL508C standard.

Table 4-8 Typical cable sizes for size 2 drives

Model			Maximum input current	Continuous output current	IEC 60364-5-52 Table A52-12 Column 5 derated by 0.91 for 40°C XLPE cables (IEC 60364-5-52 table A52-14) and 0.77 for cables bunching (IEC 60364-5-52 table A52-17 item 4)		US National Electrical Code	
					90°C cables at 40°C ambient		75°C cable at 40°C ambient	
			A	A	Input size mm²	Output size mm²	Input cables Kcmil	Output cables Kcmil
MP350A4(R)	MP350A5(R)	MP350A6(R)	313	350	120	150	350	400
MP420A4(R)			375	420	150	185	400	500
	MP470A5(R)	MP470A6(R)	420	470	185	240	500	600
MP550A4(R)			492	550	300	2 x 185	2 x 300	2 x 350
MP700A4(R)	MP700A5(R)	MP700A6(R)	626	700	2 x 150	2 x 150	2 x 500	2 x 600
MP825A4(R)	MP825A5(R)	MP825A6(R)	738	825	2 x 185	2 x 240	2 x 600	3 x 350
MP900A4(R)			805	900	2 x 185	2 x 240	3 x 350	3 x 400
MP1200A4(R)	MP1200A5(R)	MP1200A6(R)	1073	1200	2 x 300	3 x 240	3 x 600	4 x 400
MP1850A4(R)	MP1850A5(R)	MP1850A6(R)	1655	1850	4 x 240	4 x 300	*	*

* Values are beyond the mechanical design of the drive. At this power level it may be prudent to consider busbars.

Notes for IEC 60364:

NOTE

1. IEC 60364-5-52 table A 52-12 F method column 5 = Single core cable in free air.
2. IEC 60364-5-52 table A52-14 correction factor for ambient air temperature others than 30°C.
3. IEC 60364-5-52 table A52-17 item 4 correction factor for groups of more than one circuit or more than one multi-core cable placed on a single layer on a perforated tray.

Notes for US National Electrical Code:

NOTE

1. Table 310.17 allowable ampacities of single-insulated conducted rated 0 through 2000V in free air, based on ambient air temperature of 30°C (87°F).
2. Derating factor of 0.88 is applied for 40°C to the 75°C cable column. Table 310.17 is based on 30°C (86°F) ambient air temperature.
3. NEC 2005 edition table 310.15(B)(2)(a) shows the adjustment factors for more than three current-carrying conductors in a race way or cable, for 4-6 current-carrying conductors 0.80 derating factor is applied.

Table 4-9 Auxiliary wiring for size 2 drives

Frame size	Maximum input current	Continuous output current	IEC 60364-5-52 Table A52-4 Column B2		UL 508C	
			Column B2 derated by 0,87 of PVC at 40			
			E1, E3 size	F+, F- , L11 & L12 size	E1, E3 size	F+, F- , L11 & L12 size
	A	A	mm²	mm²	mm²	mm²
2	23	20	6	4	10 AWG	10 AWG

Notes for IEC 60364:
IEC 60364-5-52 use installation method B2, table A.52-4 for three loaded conductors, PVC insulation 30°C and apply derating factor for 40°C from table A.52-14 (0.87 for PVC).

Notes for UL508C: Either 60°C or 75°C cable can be used. Ampacities as per table 40.3 as described in the UL508C standard.

4.6.1 Ferraz Shawmut fuses

Ferraz Shawmut fuses are recommended for the Mentor MP.

The applications, descriptions and ratings for the Ferraz Shawmut fuses with respect to drives are shown in Table 4-10, Table 4-11 and Table 4-12.

Table 4-10 Ferraz Shawmut semiconductor fusing for size 1 drives

Model	International			USA		
	Description	Catalogue number	Ref number	Description	Catalogue number	Ref number
Field fuses	10 x 38mm Ferrule	FR10GB69V12.5	H330011	10 x 38mm Ferrule	FR10GB69V12.5	H330011
MP25A4	22 x 58mm Ferrule	FR22GC69V32	A220915	A50QS Series American Round Fuse	A50QS60-4	A218937
MP25A5						
MP45A4		FR22GC69V63	X220912	A50QS Series American Round Fuse	A50QS80-4	L201513
MP45A5						
MP75A4		FR22GC69V100	W220911	A50QS Series American Round Fuse	A50QS125-4	K218417
MP75A5						
MP25A4R		FR22GC69V32	A220915	A70QS Series American Round Fuse	A70QS60-4	H219473
MP25A5R						
MP45A4R		FR22GC69V63	X220912	A70QS Series American Round Fuse	A70QS80-4	X212816
MP45A5R						
MP75A4R		FR22GC69V100	W220911	A70QS Series American Round Fuse	A70QS125-4	Q216375
MP75A5R						
MP105A4	Size 30 Square Body Fuse	PC30UD69V160EF	M300092	A50QS Series American Round Fuse	A50QS175-4	A222663
MP105A5						
MP155A4		PC30UD69V200EF	N300093	A50QS Series American Round Fuse	A50QS250-4	W211251
MP155A5						
MP210A4		PC30UD69V315EF	Q300095	A50QS Series American Round Fuse	A50QS350-4	T215343
MP210A5						
MP105A4R	Size 70 Square Body Fuse	PC70UD13C160EF	T300604	A70QS Series American Round Fuse	A70QS175-4	A223192
MP105A5R						
MP155A4R		PC70UD13C200EF	V300605	A70QS Series American Round Fuse	A70QS250-4	L217406
MP155A5R						
MP210A4R		PC70UD12C280EF	L300712	A70QS Series American Round Fuse	A70QS350-4	M211266
MP210A5R						

NOTE A50QS series are only rated up to 500Vac.

Table 4-11 Ferraz Shawmut branch circuit protection fusing for size 1 drives

Model		International			USA
		Description	Catalogue number	Ref number	Catalogue number
Auxiliary		21 x 57mm Cylindrical	HSJ15	D235868	AJT10
MP25A4	MP25A5	22 x 58mm Ferrule	FR22GG69V25	N212072	AJT30
MP45A4	MP45A5		FR22GG69V50	P214626	AJT45
MP75A4	MP75A5		FR22GG69V80	Q217180	AJT70
MP25A4R	MP25A5R		FR22GG69V25	N212072	AJT30
MP45A4R	MP45A5R		FR22GG69V50	P214626	AJT45
MP75A4R	MP75A5R		FR22GG69V80	Q217180	AJT70
MP105A4	MP105A5	NH 00 Knife Blade	NH00GG69V100	B228460	AJT125
MP155A4	MP155A5	NH 1 Knife Blade	NH1GG69V160	F228487	AJT175
MP210A4	MP210A5		NH1GG69V200	G228488	AJT225
MP105A4R	MP105A5R	NH 00 Knife Blade	NH00GG69V100	B228460	AJT125
MP155A4R	MP155A5R	NH 1 Knife Blade	NH1GG69V160	F228487	AJT175
MP210A4R	MP210A5R		NH1GG69V200	G228488	AJT225

Table 4-12 Ferraz Shawmut DC protection fusing for size 1 drives

Model	International			USA		
	Description	Catalogue number	Ref number	Description	Catalogue number	Ref number
MP25A4R	20 x 127mm Cylindrical	FD20GB100V32T	F089498	A70QS Series American Round Fuse	A70QS60-4	H219473
MP25A5R						
MP45A4R	36 x 127mm Cylindrical	FD36GC100V80T	A083651	A70QS Series American Round Fuse	A70QS80-4	X212816
MP45A5R						
MP75A4R	20 x 127mm Cylindrical	FD20GC100V63T x 2 connected in parallel.	F083656 x 2 connected in parallel.	A70QS Series American Round Fuse	A70QS125-4	Q216375
MP75A5R						
MP105A4R	Size 120 Square Body	D120GC75V160TF	R085253	A70QS Series American Round Fuse	A70QS175-4	A223192
MP105A5R						
MP155A4R	Size 121 Square Body	D121GC75V250TF	Q085252	A70QS Series American Round Fuse	A70QS250-4	L217406
MP155A5R						
MP210A4R	Size 122 Square Body	D122GC75V315TF	M085249	A70QS Series American Round Fuse	A70QS350-4	M211266
MP210A5R						

NOTE DC fusing is required on four quadrant (R) drives only.

Table 4-13 Ferraz Shawmut semiconductor fusing for International size 2 drives

Model	International		
	Description	Catalogue number	Ref number
Field fuses	10 x 38mm Ferrule	FR10GB69V25	L330014
MP350A4	Square Body Fuses	PC30UD69V500TF	W300399
MP350A4R		PC71UD11V500TF	F300523
MP350A5 MP350A6		PC31UD69V500TF	T300006
MP350A5R MP350A6R		PC72UD13C500TF	D300498
MP420A4		PC32UD69V630TF	M300069
MP420A4R		PC272UD13C630TF	W300721
MP470A5 MP470A6		PC272UD13C700TF	X300722
MP470A5R MP470A6R			
MP550A4		PC33UD69V700TF	Y300079
MP550A4R		PC272UD13C700TF	X300722
MP700A4		PC32UD69V1000TF	S300074
MP700A4R		PC72UD10C900TF	G300869
MP700A5 MP700A6		PC32UD69V1000TF	S300074
MP700A5R MP700A6R		PC73UD12C900TF	T300512
MP825A4		PC32UD69V1100TF	M300759
MP825A5 MP825A6		PC33UD69V1100TF	C300083
MP825A4R MP825A5R MP825A6R		PC73UD95V800TFB	W300514
MP900A4		PC33UD69V1250TF	D300084
MP900A4R		PC73UD95V800TFB	W300514
MP1200A4		PC33UD60V1600TF	Z300586
MP1200A4R		PC273UD11C16CTF	J302228
MP1200A5 MP1200A6		PC232UD69V16CTD	W300215
MP1200A5R MP1200A6R		PC273UD11C16CTF	J302228
MP1850A4		**7,5 URD 44 PPSAF 2200	**K235184
MP1850A4R			
MP1850A5 MP1850A6			
MP1850A5R MP1850A6R			

NOTE A50QS series are only rated up to 500Vac.

*Application overload limited to infrequent overloads to avoid fuse wear out

**Fuse limits applications to those operating at rated current. No cyclic overloads permitted.

Table 4-14 Ferraz Shawmut semiconductor fusing for USA size 2 drives

Model	USA		
	Description	Catalogue number	Ref number
Field fuses	10 x 38mm Ferrule	FR10GB69V25	L330014
MP350A4	American Round Fuses Form 101 Range A70QS	A50QS450-4 A7OQS450-4	EQ16871 F214848
MP350A4R		A7OQS450-4	F214848
MP350A5 MP350A6		A70QS450	F214848
MP350A5R MP350A6R			
MP420A4		A50QS600-4 A70QS600-4	Q219457 Y219993
MP420A4R		A70QS600-4	Y219993
MP470A5 MP470A6		2 x A70QS400 in parallel	J214345 (x2)
MP470A5R MP470A6R			
MP550A4		A50QS700-4 A70QS700-4	N223181 E202772
MP550A4R		A70QS700-4	E202772
MP700A4		A50QS900-4 2 x A70QS500-4 in parallel	R212282 A218431 (x2)
MP700A4R		2 x A70QS500 in parallel	A218431 (x2)
MP700A5 MP700A6			
MP700A5R MP700A6R			
MP825A4		A50QS1200-4 2 x A70QS600-4 in parallel	C217904 Y219993 (x2)
MP825A5 MP825A6		2 x A7OQS600-4 in parallel	Y219993 (x2)
MP825A4R MP825A5R MP825A6R			
MP900A4		A50QS1200-4 2 x A7OQS600-4 in parallel	C217904 Y219993 (x2)
MP900A4R		2 x A7OQS600-4 in parallel	Y219993 (x2)
MP1200A4		2 x A5OQS800-4 in parallel 2 x A70QS800-4 in parallel	C202287 (x2) Z213830 (x2)
MP1200A4R		2 x A70QS800-4 in parallel	Z213830 (x2)
MP1200A5 MP1200A6			
MP1200A5R MP1200A6R			
MP1850A4		2 x A5OQS1000-4 in parallel *3 x A7OQS700-4 in parallel	B217391 (x2) *E202772 (x3)
MP1850A4R		*3 x A7OQS700-4 in parallel	*E202772 (x3)
MP1850A5 MP1850A6			
MP1850A5R MP1850A6R			

NOTE A50QS series are only rated up to 500Vac.

*Application overload limited to infrequent overloads to avoid fuse wear out

**Fuse limits applications to those operating at rated current. No cyclic overloads permitted.

Table 4-15 Ferraz Shawmut branch circuit protection fusing for International size 2 drives

Model		International		
		Description	Catalogue number	Ref number
Auxiliary		25A 600Vac High Speed Class J	HSJ205	G235871J
MP350A4(R)	MP350A5(R) MP350A6(R)	General purpose IEC (square body)	NH2GG69V355	Y228503
MP420A4(R)			NH3GG69V400	D228508
MP470A5(R) MP470A6(R)			NH4GG69V630-8 NH4AGG69V630-8	E215537 W222107
MP550A4 (R)			NH4GG69V630-8 NH4AGG69V630-8	E215537 W222107
MP700A4(R)	MP700A5(R) MP700A6(R)		NH4GG69V800-8 NH4AGG69V800-8	K216554 M222858
MP825A4(R) MP825A5(R) MP825A6(R)			NH4GG69V800-8 NH4AGG69V800-8	K216554 M222858
MP900A4R)		General purpose IEC (round body)	MF76GG69V1250	E302753
MP1200A4(R)	MP1200A5(R) MP1200A6(R)			
MP1850A4(R)	MP1850A5(R) MP1850A6(R)		MF114GG69V2000	G302755

Table 4-16 Ferraz Shawmut branch circuit protection fusing for USA size 2 drives

Model		USA		
		Description	Catalogue number	Ref number
Auxiliary		25A 600Vac High Speed Class J	AJT25R	X21160J
MP350A4(R)	MP350A5(R) MP350A6(R)	General purpose US (round body)	A6D400R	B216776
MP420A4(R)			A6D500R	P217294
MP470A5(R) MP470A6(R)			A6D600R	T217804
MP550A4 (R)				
MP700A4(R)	MP700A5(R) MP700A6(R)		A4BQ800	Z219373
MP825A4(R) MP825A5(R) MP825A6(R)				
MP900A4R)			A4BQ1000	P216282
MP1200A4(R)	MP1200A5(R) MP1200A6(R)		A4BQ1200	R216790
MP1850A4(R)	MP1850A5(R) MP1850A6(R)		A4BQ2000	B223101

NOTE USA fuses are only rated up to 600Vac.

Table 4-17 Ferraz Shawmut DC protection fusing for size 2 drives

Model	International			USA		
	Description	Catalogue number	Ref number	Description	Catalogue number	Ref number
MP350A4R	Square Body fuse	D123GB75V630 TF	C098557	American round fuse	A70QS600-4	Y219993
MP350A5R MP350A6R					A100P600-4	A217373
MP420A4R		D123GB75V800 TF	J220946		A70QS800-4	Z213830
MP470A5R MP470A6R		D2122GD75V900TF	T220955	American round fuses 2 in parallel	A100P1000-4 (x2)	Y217371 (x2)
MP550A4R					A70QS450-4 (x2)	F214848 (x2)
MP700A4R		D2123GB75V12 CTF	D098558		A70QS600-4 (x2)	Y219993 (x2)
MP700A5R MP700A6R				American round fuse	A100P1200-4	N218397
MP825A4R				American round fuses 2 in parallel	A70QS800-4 (x2)	Z213830 (x2)
MP825A5R MP825A6R				American round fuse	A100P1200-4	N218397
MP900A4R		D2123GB75V14 CTF	B090483	American round fuses 3 in parallel	A70QS600-4 (x3)	Y219993 (x3)
MP1200A4R	Square Body fuses 3 in parallel	PC73UD13C630 TF (x3)	Q300509 (x3)	American round fuses 3 in parallel	A70QS700-4 (x3)	E202772 (x3)
MP1200A5R MP1200A6R					A100P700-4 (x3)	T223163 (x3)
MP1850A4R	Square Body fuses 4 in parallel	PC73UD13C700 TF (x4)	R300510 (x4)	American round fuses 5 in parallel	A70QS600-4 (x5)	Y219993 (x5)
MP1850A5R MP1850A6R					A100P600-4 (x5)	A217373 (x5)

NOTE The use of the A100P series fuses is limited to applications with L/R time constants of 30ms or less.

DC fusing is only required on four quadrant (R) drives.

4.6.2 Alternative fusing

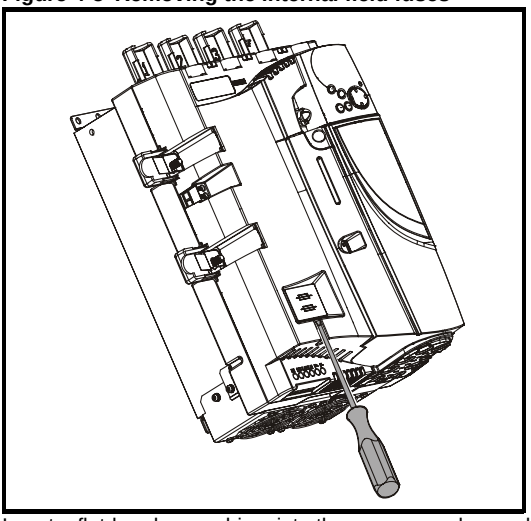
Cooper Bussmann or Siba fuses are an acceptable alternative (refer to the *Mentor MP User Guide* for more details).

4.6.3 Internal field fuses

The internal field fuses provide protection to the field controller. The fuses can rupture if there is a fault in the field circuit. The user should check the internal field fuses if the drive is tripping field loss (FdL) and the field controller is enabled.

Isolate the power before removing the internal field fuses.

Figure 4-5 Removing the internal field fuses



Insert a flat-head screwdriver into the groove as shown above and lever downwards to remove the fuse cover. Refer to section 4.6.1 *Ferraz Shawmut fuses* on page 41 for fuse types.

4.7 Shield connections

These instructions must be followed to ensure suppression of radio-frequency emission and good noise immunity in the encoder circuit. It is recommended that the instructions for the connection of the encoder cable be followed closely and, to use the grounding bracket and grounding clamp supplied with the drive, to terminate the shields at the drive.

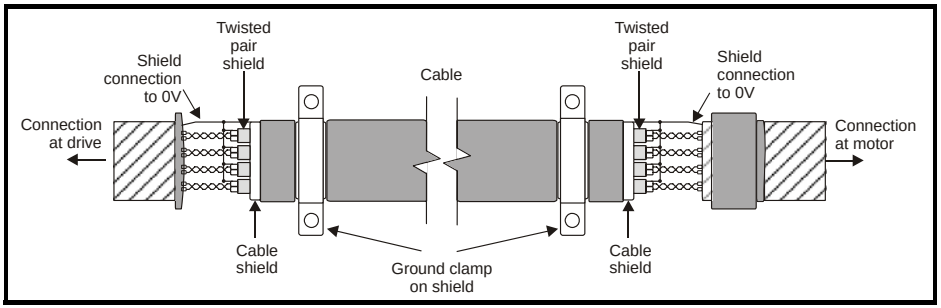
4.7.1 Motor cables

Use of a motor cable with an overall shield for the armature and field circuits may be needed if there is a critical EMC emissions requirement. Connect the shield of the motor cable to the ground terminal of the motor frame using a link that is as short as possible and not exceeding 50mm (2in) long. A full 360° termination of the shield to the terminal housing of the motor is beneficial.

4.7.2 Encoder cable

To get the best results from shielding use cable with an overall shield and separate shields on individual twisted pairs. Connect the cable as illustrated in Figure 4-6. Assemble and clamp the overall shield to the grounded metallic surfaces at the encoder and at the drive ends of the cable.

Figure 4-6 Shielded cable assembly



4.7.3 Control cables

It is recommended that signal cables should be shielded. This is essential for encoder cables, and strongly recommended for analog signal cables. For digital signals it is not necessary to use shielded cables within a panel, but this is recommended for external circuits, especially for inputs where a momentary signal causes a change of state (i.e. latching inputs).

4.8 Connecting the fan on size 2C and 2D drives

A supply needs to be connected to the dual fan unit enclosed within the lower duct on Mentor MP size 2C and 2D. The fans can be configured for a 230Vac (factory setting) or 115Vac supply as shown below on the label next to the fan connections. When connecting the fan supply, the screws should be tightened with a maximum torque of 1.2 Nm (0.88 lb ft) to 2 Nm (1.47 lb ft).

Figure 4-7 Fan connection

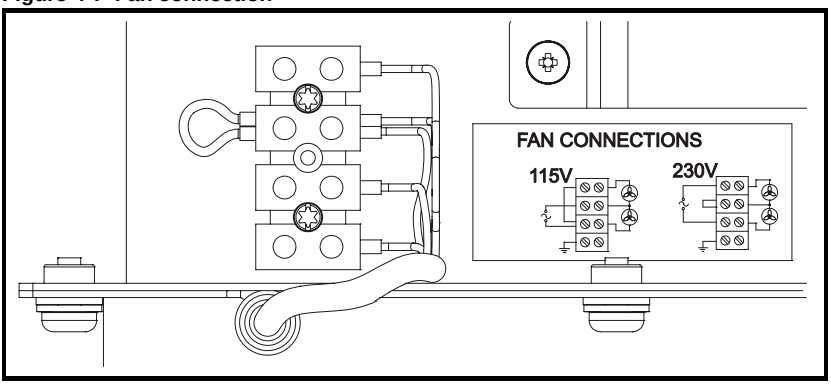


Table 4-18 Fan supply specification

Fan configuration	Supply specification
230V	230V ±10%
115V	115V ±10%

Cabling should be 300V rated. Rated for at least 3A continuous in line with local wiring regulations. Cabling should be protected 3A non time delay fuses i.e. gG, Class CC or Class J and rated for at least 300V, in accordance with local wiring regulations.

4.9 Control connections

Refer to Figure 4-8 to understand the connection of the different power connections.

If the control circuits are to be connected to other circuits classified as Safety Extra Low Voltage (SELV) (e.g. to a personal computer), an additional isolating barrier must be included in order to maintain the SELV classification.

If any of the digital inputs (including the drive enable input) are connected in parallel with an inductive load (i.e. contactor or motor brake) then suitable suppression (i.e. diode or varistor) should be used on the coil of the load. If no suppression is used then over voltage spikes can cause damage to the digital inputs on the drive.

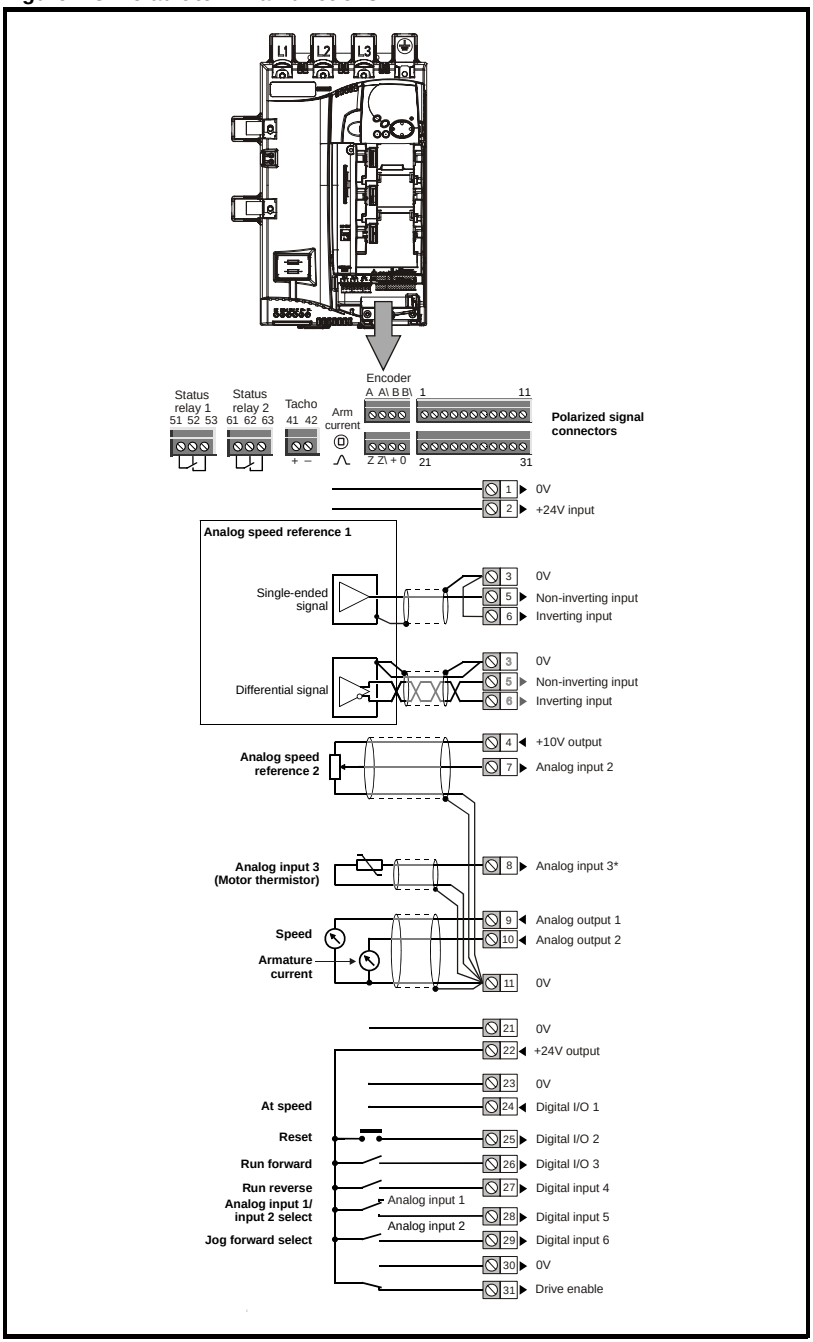
The control circuits are isolated from the power circuits in the drive by basic insulation (single insulation) only. The installer must ensure that the external control circuits are insulated from human contact by at least one layer of insulation (supplementary insulation) rated for use at the AC supply voltage

Status relay contacts are over-voltage category II.

A fuse or other over-current protection should be installed to the relay circuit.

For the full terminal descriptions, refer to the *Mentor MP User Guide.*

Figure 4-8 Default terminal functions



* Thermistor disabled by USA defaults.

4.9.1 Serial communications connections

The Mentor MP has a serial communications port (serial port) as standard supporting two wire EIA(RS)-485 communications.

Figure 4-9 Serial communications port

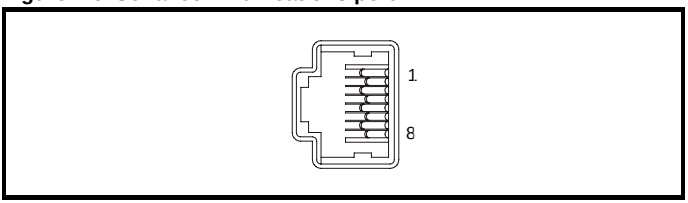


Table 4-19 RJ45 connections

Pin	Function
1	120Ω Termination resistor
2	RX TX
3	0V isolated
4	+24V (100 mA)
5	0V isolated
6	TX enable
7	RX\ TX\
8	RX\ TX\ (if termination resistors are required, link to pin 1)
Shell	0V isolated

The communications port applies a two-unit load to the communications network. Connectors 2, 3, 7 and shield must always be made to the serial communications port. Shielded cable must be used at all times.

In order to meet the requirements for SELV in IEC 60950 (IT equipment) it is necessary for the control computer to be grounded. Alternatively, when a lap-top or similar device is used which has no provision for grounding, an isolation device must be incorporated in the communications lead.

5 Getting started

This chapter introduces the user interfaces, menu structure and security level of the drive.

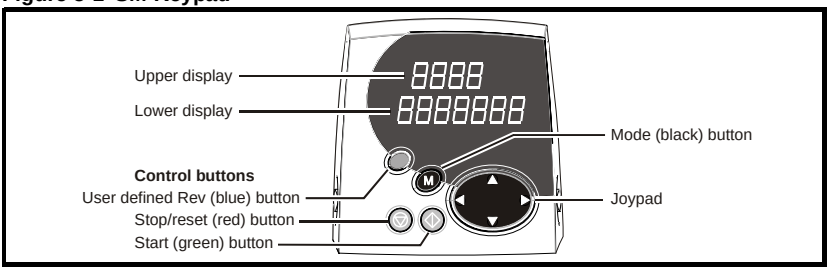
5.1 Understanding the display

There are two types of keypad available for the Mentor MP. The SM-Keypad has an LED display, and the MP-Keypad has an LCD display.

5.1.1 SM-Keypad (LED)

The display consists of two horizontal rows of 7 segment LED displays.
The upper display shows the drive status or the current menu and parameter number being viewed.
The lower display shows the parameter value or the specific trip type.

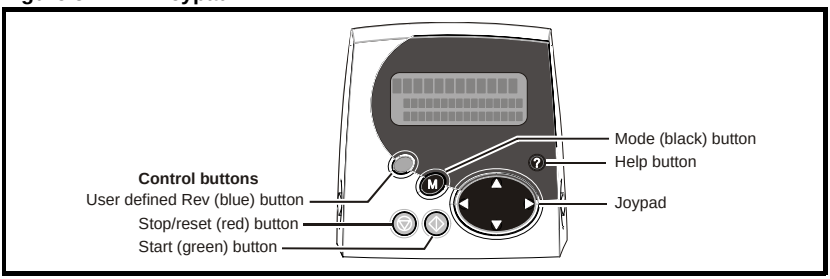
Figure 5-1 SM-Keypad



5.1.2 MP-Keypad (LCD)

The display consists of three lines of text.
The top line shows the drive status or the current menu and parameter number being viewed on the left, and the parameter value or the specific trip type on the right.
The lower two lines show the parameter name or the help text.

Figure 5-2 MP-Keypad



NOTE The red stop button is also used to reset the drive.

5.2 Keypad operation

Control buttons

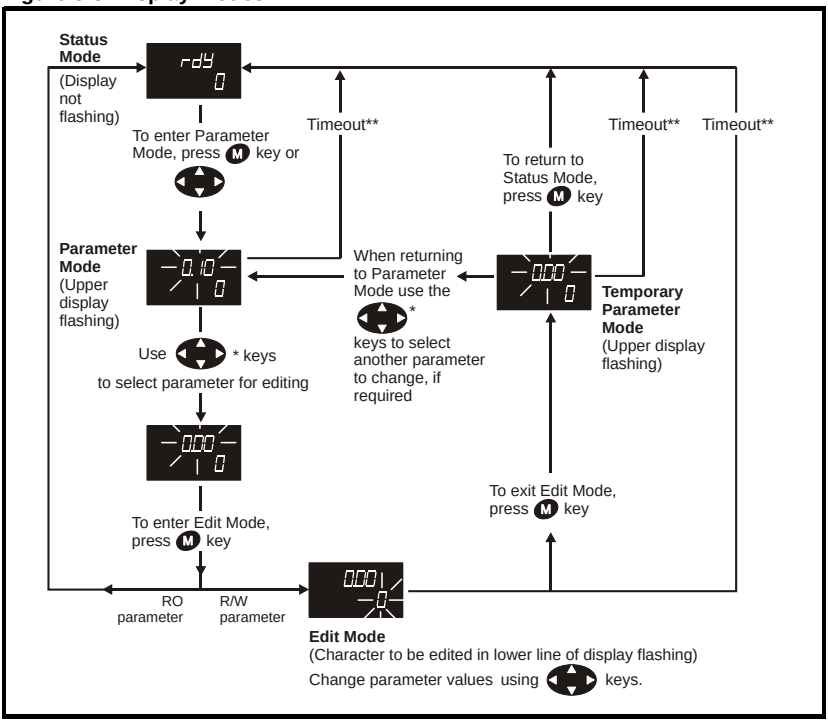
The keypad consists of:

1. Joypad - used to navigate the parameter structure and change parameter values.
2. Mode button - used to change between the display modes – parameter view, parameter edit, status.
3. Three control buttons - used to control the drive if keypad mode is selected. Refer to the *Mentor MP User Guide* for further information.
4. Help button (MP-Keypad only) - displays text briefly describing the selected parameter.

The Help button toggles between other display modes and parameter help mode. The up and down functions on the joypad scroll the help text to allow the whole string to be viewed. The right and left functions on the joypad have no function when help text is being viewed.

The display examples in this section show the SM-Keypad, seven segment, LED display. The examples are the same for the MP-Keypad, The exceptions is that the information displayed on the lower row on the SM-Keypad is displayed on the right hand side of the top row on the MP-Keypad.

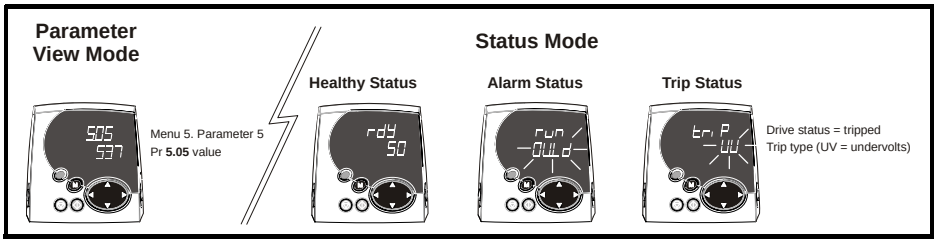
Figure 5-3 Display modes



* Can only be used to move between menus if L2 access has been enabled Pr **11.44** (**SE14, 0.35**)

Time-out defined by Pr **11.41 (default value = 240s).

Figure 5-4 Mode examples



Do not change parameter values without careful consideration; incorrect values may cause damage or a safety hazard.

NOTE When changing the values of parameters, make a note of the new values in case they need to be entered again.

NOTE For new parameter-values to apply after the AC supply to the drive is interrupted, new values must be saved (section 5.8 *Saving parameters* on page 64).

5.3 Menu 0 (sub block)

Menu 0 can be accessed by 2 methods:

1. Pr **11.44** (**SE14, 0.35**) = 0. Sub block mode.
2. Pr **11.44** (**SE14, 0.35**) <>0. Linear mode.

Menu 23 contains the parameters to allow menu 0 to be customized in sub block mode. The first sub block is a user defined area (USEr) which is configured by the parameters in menu 22. As default there are no parameters configured to the user sub block and so it is empty. The next 7 sub blocks are pre-defined. Access to the pre-defined blocks is enabled or disabled by Pr **23.03** to Pr **23.09**.

Movement between sub blocks is achieved with the left and right keys.

Pr **23.01** contains all the sub block headers.

Table 5-1 and Figure 5-5 show the result of the direction keys when Pr **11.44** (**SE14, 0.35**) is set to L1 (0). When Pr **11.44** (**SE14, 0.35**)is not 0 the left and right keys will allow access to the advance parameter set and menu 0 will become a linear menu.

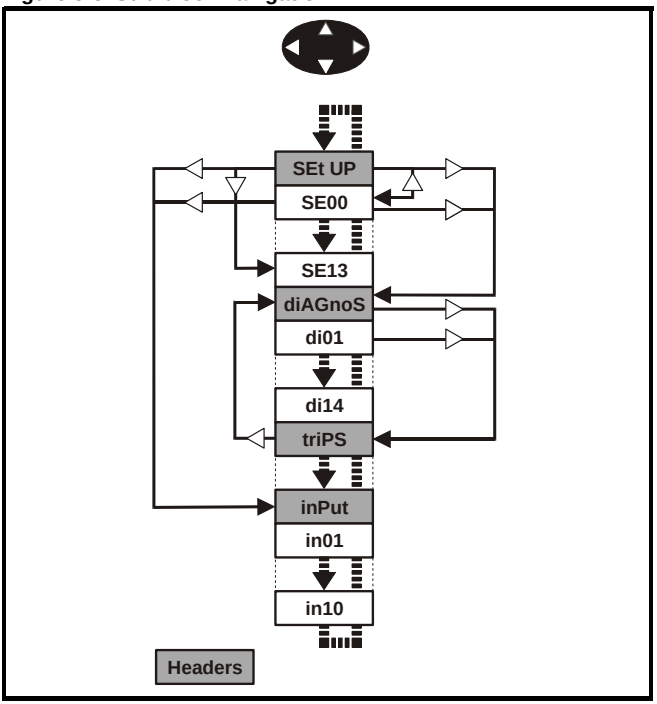
Table 5-1 Keypad navigation

Starting location	Action	Finishing location
Header	Right	Next header
	Left	Previous header
	Up	First parameter in header block
	Down	Last parameter in header block
Parameter	Right	Next header
	Left	Previous header
	Up	Next parameter in header block
	Down	Previous parameter in header block

When moving to the user block header, the user block header is only displayed if there are some valid parameters in the block. When moving between pre-defined header blocks the pre-defined header block is only displayed if the pre-defined block is enabled.

When moving between parameters within a block, only valid parameters are displayed.

Figure 5-5 Sub block navigation



Coding

The coding defines the attributes of the parameter as follows.

Coding	Attribute
{X.XX}	Copied Menu 0 or advanced parameter.
Bit	Binary parameter: 'On' or 'OFF' on the display.
Bi	Bipolar parameter.
Uni	Unipolar parameter.
Txt	Text: the parameter uses text strings instead of numbers.
SP	Spare: not used.
FI	Filtered: some parameters which can have rapidly changing values are filtered when displayed on the drive keypad for easy viewing.
DE	Destination pointer parameter: This parameter can be used to set up the location (i.e. menu/parameter number) where the destination data is to be routed.
VM	Variable maximum: the maximum of this parameter can vary.
DP	Decimal place: indicates the number of decimal places used by this parameter.
ND	No default: when defaults are loaded (except when the drive is manufactured or on EEPROM failure) this parameter is not modified.
RA	Rating dependant: this parameter is likely to have different values and ranges with drives of different voltage and current ratings. Parameters with this attribute will not be transferred to the destination drive by a SMARTCARD when the rating of the destination drive is different from the source drive if the drive voltage ratings are different or the file is a parameter file. However, the value will be transferred if only the current rating is different and the file is a differences from default type file.
NC	Not copied: not transferred to or from SMARTCARD during copying.
NV	Not visible: not visible on the keypad.
PT	Protected: cannot be used as a destination.
US	User save: saved in drive EEPROM when the user initiates a parameter save.
RW	Read/write: can be written by the user.
RO	Read only: can only be read by the user
BU	Bit default one/unsigned: Bit parameters with this flag set to one have a default of one (all other bit parameters have a default of zero. Non-bit parameters are unipolar if this flag is one.
PS	Power-down save: parameter automatically saved in drive EEPROM when the under volts (UV) trip occurs. Power-down save parameters are also saved in the drive when the user initiates a parameter save.

23.01	Sub block headers								
RO	Txt	NC					PT		BU
⇳	USEr (0), SEt UP (1), diAGnoS (2), triPS (3), SP LOOP (4), Fb SP (5), SintEr (6), inPut (7)				⇨	USEr (0)			

Defines the sub block headers. Can be used by the MP-Keypad to display the same strings as the SM-Keypad.

23.02	Binary sum of pre-defined sub block enables								
RO		NC					PT		BU
⇳	0 to 127				⇨	0			

The OR of Pr **23.03** to Pr **23.09**. To be used by the MP-Keypad.

Parameter	Value
23.03	1
23.04	2
23.05	4
23.06	8
23.07	16
23.08	32
23.09	64

23.03 - 23.09	Pre-defined sub block enable								
RW	Bit							US	BU
⇳	0 to1				⇨	1			

When this parameter is set to 1 the associated pre-defined sub block is accessible. When this parameter is 0 the associated pre-defined block is bypassed.

Parameter	Description	Display
23.03	Set up	SEt UP
23.04	Diagnostic	diAGnoS
23.05	Trips	triPS
23.06	Speed loop	SP LOOP
23.07	Serial interface	SintEr
23.08	Speed feedback	Fb SP
23.09	IO	InPut

5.4 Pre-defined sub blocks

Menu 0	Parameter	Description	Display
00.01 to 00.20		Configured by Pr **22.01** to Pr **22.20**	

Set-up

Menu 0	Parameter	Description	Display
00.21	**1.00**	Parameter 0	**SE00**
00.22	**1.07**	Minimum reference clamp	**SE01**
00.23	**1.06**	Maximum reference clamp	**SE02**
00.24	**2.11**	Acceleration rate	**SE03**
00.25	**2.21**	Deceleration rate	**SE04**
00.26	**1.14**	Reference selector	**SE05**
00.27	**5.09**	Armature rated voltage	**SE06**
00.28	**5.07**	Motor rated current	**SE07**
00.29	**5.08**	Base speed	**SE08**
00.30	**11.42**	Parameter copying	**SE09**
00.31	**5.70**	Rated field current	**SE10**
00.32	**5.73**	Rated field voltage	**SE11**
00.33	**5.77**	Enable field control	**SE12**
00.34	**5.12**	Autotune	**SE13**
00.35	**11.44**	Security status	**SE14**

Diagnostic

Menu 0	Parameter	Description	Display
00.36	**1.01**	Speed reference selected	**di01**
00.37	**1.03**	Pre-ramp reference	**di02**
00.38	**2.01**	Post ramp reference	**di03**
00.39	**3.01**	Final speed reference	**di04**
00.40	**3.02**	Speed feedback	**di05**
00.41	**3.04**	Speed controller output	**di06**
00.42	**4.03**	Torque demand	**di07**
00.43	**4.01**	Current magnitude	**di08**
00.44	**5.56**	Field current feedback	**di09**
00.45	**5.02**	Armature voltage	**di10**
00.46	**1.11**	Reference enabled indicator	**di11**
00.47	**1.12**	Reverse selected indicator	**di12**
00.48	**1.13**	Jog selected indicator	**di13**
00.49	**11.29**	Software version	**di14**
00.50	**0.00**	Spare	

Trips

Menu 0	Parameter	Description	Display
00.51	**10.20**	Trip 0	**tr01**
00.52	**10.21**	Trip 1	**tr02**
00.53	**10.22**	Trip 2	**tr03**
00.54	**10.23**	Trip 3	**tr04**
00.55	**10.24**	Trip 4	**tr05**
00.56	**10.25**	Trip 5	**tr06**
00.57	**10.26**	Trip 6	**tr07**
00.58	**10.27**	Trip 7	**tr08**
00.59	**10.28**	Trip 8	**tr09**
00.60	**10.29**	Trip 9	**tr10**

Speed loop

Menu 0	Parameter	Description	Display
00.61	**3.10**	Speed controller proportional gain	**SP01**
00.62	**3.11**	Speed controller integral gain	**SP02**
00.63	**3.12**	Speed controller differential feedback gain	**SP03**
00.64	**0.00**	Spare	
00.65	**0.00**	Spare	

Serial interface

Menu 0	Parameter	Description	Display
00.66	**11.25**	Baud rate	**Si01**
00.67	**11.23**	Serial address	**Si02**
00.68	**0.00**	Spare	
00.69	**0.00**	Spare	
00.70	**0.00**	Spare	

Speed feedback

Menu 0	Parameter	Description	Display
00.71	**3.26**	Speed feedback selector	**Fb01**
00.72	**3.51**	Tachometer rating (V/ 1000rpm)	**Fb02**
00.73	**3.53**	Tachometer input mode	**Fb03**
00.74	**3.52**	Tachometer speed feedback	**Fb04**
00.75	**3.34**	Drive encoder lines per revolution	**Fb05**
00.76	**3.36**	Encoder supply	**Fb06**
00.77	**3.38**	Encoder type	**Fb07**
00.78	**3.39**	Encoder termination select	**Fb08**
00.79	**3.27**	Encoder speed feedback	**Fb09**
00.80	**0.00**	Spare	

IO

Menu 0	Parameter	Description	Display
00.81	**7.15**	Analog input 3 mode	**in01**
00.82	**7.01**	Analog input 1	**in02**
00.83	**7.02**	Analog input 2	**in03**
00.84	**7.03**	Analog input 3	**in04**
00.85	**8.01**	I/O state 1	**in05**
00.86	**8.02**	I/O state 2	**in06**
00.87	**8.03**	I/O state 3	**in07**
00.88	**8.04**	I state 4	**in08**
00.89	**8.05**	I state 5	**in09**
00.90	**8.06**	I state 6	**in10**

For more information on the sub block function please refer to the *Mentor MP Advanced User Guide*.

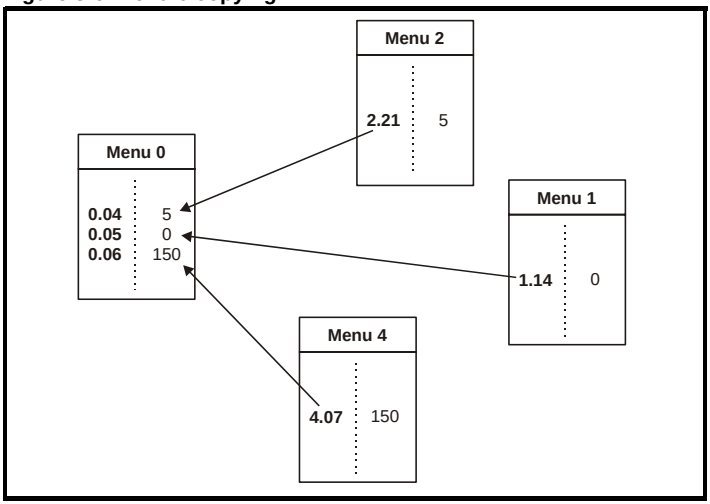
5.5 Menu 0 (linear)

Menu 0 is used to bring together various commonly used parameters for basic easy set up of the drive.

Appropriate parameters are copied from the advanced menus into menu 0 and thus exist in both locations.

For further information, refer to section 5.3 *Menu 0 (sub block)* on page 55.

Figure 5-6 Menu 0 copying



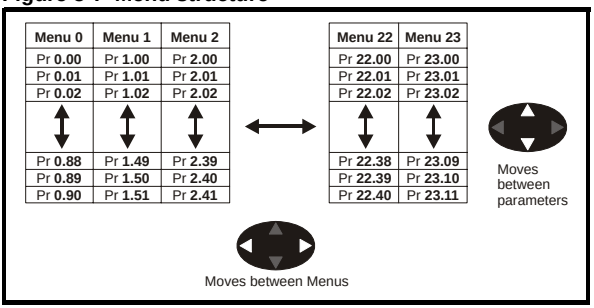
5.6 Menu structure

The drive parameter structure consists of menus and parameters.

The drive initially powers up in sub menu mode. Once Level 2 access (L2) has been enabled (refer to Pr **11.44** (**SE14, 0.35**)) the left and right buttons are used to navigate between numbered menus.

For further information, refer to section 5.13 *Parameter access level and security* on page 66.

Figure 5-7 Menu structure



The menus and parameters roll over in both directions.

For example:

- If the last parameter is displayed, a further press will cause the display to rollover and show the first parameter.
- When changing between menus the drive remembers which parameter was last viewed in a particular menu and will display that parameter. The menus and parameters roll over in both directions.

5.7 Advanced menus

The advanced menus consist of groups of parameters appropriate to a specific function or feature of the drive. Menus 0 to 23 can be viewed on both keypads. Menus 40 and 41 are specific to the MP-Keypad (LCD). Menus 70 to 91 can be viewed with an MP-Keypad (LCD) only when an SM-Applications module is installed.

Table 5-2 Advanced menu descriptions

Menu	Description	LED	LCD
0	Commonly used basic set up parameters for quick / easy programming	✓	✓
1	Speed reference	✓	✓
2	Ramps	✓	✓
3	Speed feedback and speed control	✓	✓
4	Torque and current control	✓	✓
5	Motor control including field regulator	✓	✓
6	Sequencer and clock	✓	✓
7	Analog I/O	✓	✓
8	Digital I/O	✓	✓
9	Programmable logic, motorized pot and binary sum	✓	✓
10	Status and trips	✓	✓
11	General drive set-up	✓	✓
12	Threshold detectors and variable selectors	✓	✓
13	Position control	✓	✓
14	User PID controller	✓	✓
15	Solutions Module set-up	✓	✓
16	Solutions Module set-up	✓	✓
17	Solutions Module set-up	✓	✓
18	Application menu 1	✓	✓
19	Application menu 2	✓	✓
20	Application menu 3	✓	✓
21	Second motor parameters	✓	✓
22	Menu 0 set-up - user area	✓	✓
23	Menu 0 sub block control	✓	✓
40	Keypad configuration menu	X	✓
41	User filter menu	X	✓
70	PLC registers	X	✓
71	PLC registers	X	✓
72	PLC registers	X	✓
73	PLC registers	X	✓
74	PLC registers	X	✓
75	PLC registers	X	✓
85	Timer function parameters	X	✓
86	Digital I/O parameters	X	✓
88	Status parameters	X	✓
90	General parameters	X	✓
91	Fast access parameters	X	✓

Key: ✓= Available
X = Not available

Table 5-3 Menu 40 parameter descriptions

Parameter		Range(⇳)
40.00	Parameter 0	0 to 32767
40.01	Language selection	English (0), Custom (1), French (2), German (3), Spanish (4), Italian (5)
40.02	Software version	999999
40.03	Save to flash	Idle (0), Save (1), Restore (2), Default (3)
40.04	LCD contrast	0 to 31
40.05	Drive and attribute database upload was bypassed	Updated (0), Bypass (1)
40.06	Browsing favourites control	Normal (0), Filter (1)
40.07	Keypad security code	0 to 999
40.08	Communication channel selection	Disable (0), Slot1 (1), Slot2 (2), Slot3 (3), Slave (4), Direct (5)
40.09	Hardware key code	0 to 999
40.10	Drive node ID (Address)	0 to 255
40.11	Flash ROM memory size	4Mbit (0), 8Mbit (1)
40.19	String database version number	0 to 999999
40.20	Screen saver strings and enable	None (0), Default (1), User (2)
40.21	Screen saver interval	0 to 600
40.22	Turbo browse time interval	0 to 200ms
40.23	Connected drive type	Unidrive SP (0), DIGIDRIVE SK (1), Mentor MP (2), Affinity (4), Digitax ST (5)

Table 5-4 Menu 41 parameter descriptions

Parameter		Range(⇳)
41.00	Parameter 0	0 to 32767
41.01 to 41.50	Browsing filter source F01 to F50	Pr **0.00** to Pr **22.99**
41.51	Browsing favourites control	Normal (0), Filter (1)

5.8 Saving parameters

When changing a parameter in Menu 0, the new value is saved when pressing the M Mode button to return to parameter view mode from parameter edit mode.

If parameters have been changed in the advanced menus, then the change will not be saved automatically. A save function must be carried out.

Procedure

1. Enter SAVE in Pr **xx.00**
2. Either:
   - Press the red reset button
   - Toggle the reset digital input, or
   - Carry out a drive reset through serial communications by setting Pr **10.38** to 100 (ensure that Pr **xx.00** returns to 0).

5.9 Restoring parameter defaults

Restoring parameter defaults by this method saves the default values in the drive's memory (Pr **11.44** (**SE14, 0.35**) and Pr **11.30** are not affected by this procedure).

Procedure

1. Ensure the drive is not enabled, i.e. terminal 31 is open or Pr **6.15** is OFF (0)
2. Select Eur or USA in Pr **xx.00**.
3. Either:
   - Press the red reset button
   - Toggle the reset digital input, or
   - Carry out a drive reset through serial communications by setting Pr **10.38** to 100 (ensure that Pr. **xx.00** returns to 0).

5.10 Differences between European and USA defaults

Pr	Description	Default
2.06	S ramp enable	Eur: OFF (0), USA: On (1)
3.51	Tachometer voltage rating **(Fb02, 0.72)**	Eur: 60.00, USA: 50.00
5.09, **21.09**	Armature rated voltage **(SE06, 0.27)**	480V drive Eur: 440, USA:500
5.28	Field weakening compensation disable	Eur: OFF (0), USA On (1)
5.59, **21.08**	Back emf set point	480V drive Eur: 440, USA:500
5.65	Economy timeout	Eur: OFF (0), USA: On (1)
5.70, **21.24**	Rated field current **(SE10, 0.31)**	Size 1: Eur: 2.00, USA: 8.00 Size 2A & B Eur: 3.00, USA: 20.00 Size 2C & D Eur: 5.00, USA 20.00
5.73, **21.23**	Rated field voltage **(SE11, 0.32)**	Eur: 360, USA: 300
5.75	Field voltage mode	Eur: OFF (0), USA: On (1)
7.15	Analog input 3 mode **(in01, 0.81)**	Eur: th (8), USA: VOLt (6)

5.11 Displaying parameters with non-default values only

Select dIS.dEf in Pr **xx.00**, the only parameters that will be visible to the user will be those containing a non-default value. This function does not require a drive reset to become active. To deactivate this function, return to Pr **xx.00** and enter a value of 0.

Please note that this function can be affected by the access level enabled. You must refer to section 5.13 *Parameter access level and security* for more information regarding access level.

5.12 Displaying destination parameters only

Select dIS.dESt in Pr **xx.00**, the only parameters that will be visible to the user will be destination parameters. This function does not require a drive reset to become active. To deactivate this function, return to Pr **xx.00** and enter a value of 0.

Please note that this function can be affected by the access level enabled You must refer to section 5.13 *Parameter access level and security* for further information regarding access levels.

5.13 Parameter access level and security

The parameter access levels determine whether the user has access to Menu 0 (in sub block mode) only or to all of the advanced menus (Menus 1 to 23), in addition to Menu 0 (in linear mode).

The user security determines whether the access to the user is read only or read write. The user security and the parameter access level can operate independently of each other as shown in Table 5-5 .

Table 5-5 User security and parameter access levels

Parameter access level	User security	Menu 0 status	Advanced menus status
L1	Open	Sub block RW	Not visible
L1	Closed	Sub block RO	Not visible
L2	Open	Linear RW	RW
L2	Closed	Linear RO	RO

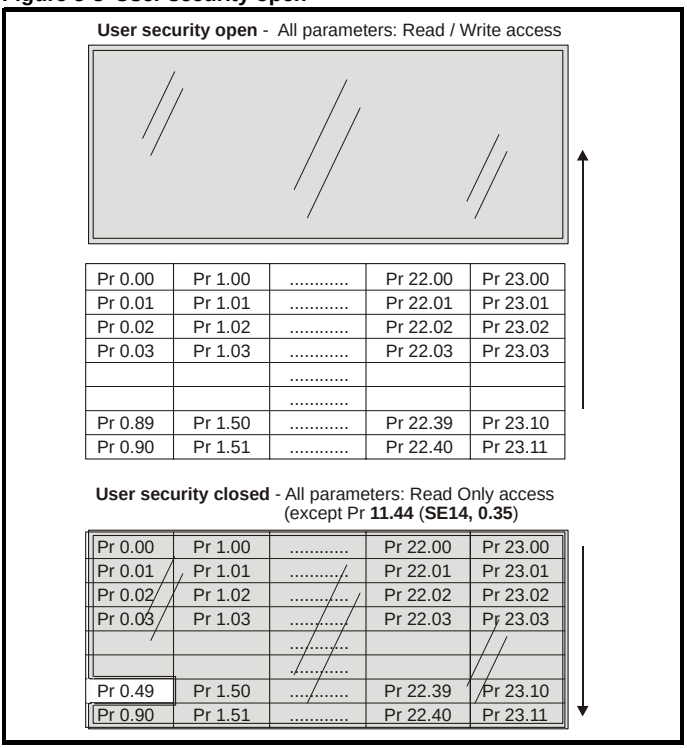
RW = Read / write access RO = Read only access

The default settings of the drive are parameter access level L1 and User Security Open, i.e. read / write access to Menu 0 with the advanced menus, not visible

5.13.1 User security

The user security, when set, prevents write access to any of the parameters (other than Pr **11.44** (**SE14, 0.35**) Access Level) in any menu.

Figure 5-8 User security open


User security open - All parameters: Read / Write access
Pr 0.00 Pr 1.00 ..... Pr 22.00 Pr 23.00
Pr 0.01 Pr 1.01 ..... Pr 22.01 Pr 23.01
Pr 0.02 Pr 1.02 ..... Pr 22.02 Pr 23.02
Pr 0.03 Pr 1.03 ..... Pr 22.03 Pr 23.03
Pr 0.89 Pr 1.50 ..... Pr 22.39 Pr 23.10
Pr 0.90 Pr 1.51 ..... Pr 22.40 Pr 23.11
User security closed - All parameters: Read Only access
(except Pr **11.44** (**SE14, 0.35**)
Pr 0.00 Pr 1.00 ..... Pr 22.00 Pr 23.00
Pr 0.01 Pr 1.01 ..... Pr 22.01 Pr 23.01
Pr 0.02 Pr 1.02 ..... Pr 22.02 Pr 23.02
Pr 0.03 Pr 1.03 ..... Pr 22.03 Pr 23.03
Pr 0.49 Pr 1.50 ..... Pr 22.39 Pr 23.10
Pr 0.90 Pr 1.51 ..... Pr 22.40 Pr 23.11

5.13.2 Setting user security

Enter a value between 1 and 999 in Pr **11.30** and press the M button; the security code has now been set to this value. To activate the security, the access level must be set to Loc in Pr **11.44** (**SE14, 0.35**). When the drive is reset, the security code will have been activated and the drive returns to access level L1. The value of Pr **11.30** will return to 0 in order to hide the security code. At this point, the only parameter that can be changed by the user is the access level Pr **11.44** (**SE14, 0.35**).

5.13.3 Unlocking user security

Select a read write parameter to be edited and press the M button; the upper display will now show CodE.

Use the arrow buttons to set the security code and press the M button. With the correct security code entered, the display will revert to the parameter selected in edit mode. If an incorrect security code is entered the display will revert to parameter view mode.

To lock the user security again, set Pr **11.44** (**SE14, 0.35**) to Loc and press the M reset button.

5.13.4 Disabling user security

Unlock the previously set security code as detailed above. Set Pr **11.30** to 0 and press the M button. The user security has now been disabled, and will not have to be unlocked each time the drive is powered up to allow read / write access to the parameters.

6 Running the motor

This chapter takes the new user through all the essential steps to running a motor for the first time, in each of the possible operating modes.

WARNING

Ensure that no damage or safety hazard could arise from the motor starting unexpectedly.

CAUTION

The values of the motor parameters affect the protection of the motor.
The default values in the drive should not be relied upon.
It is essential that the correct value is entered in Pr **5.07** (**SE07**, **0.28**) *Motor rated current*. This affects the thermal protection of the motor.

CAUTION

If the keypad mode has been used previously, ensure that the keypad reference has been set to 0 using the buttons as if the drive is started using the keypad it will run to the speed defined by the keypad reference (Pr **1.17**).

WARNING

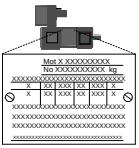
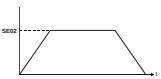
If the intended maximum speed affects the safety of the machinery, additional independent over-speed protection must be used.

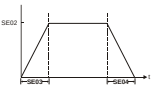
Table 6-1 Minimum control connection requirements for each control mode

Drive control method	Requirements
Terminal mode	Drive enable Speed reference Run forward or run reverse command
Keypad mode	Drive enable
Serial communications	Drive enable Serial communications link

Refer to Figure 4-1 *Power connections for 480V drive* on page 32 for minimum connections to get a motor running.

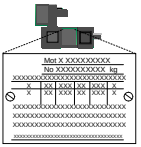
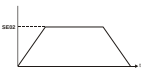
6.1 Quick start commissioning / start-up (from European defaults)

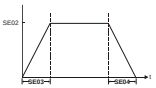
Action	Detail	
Before power-up	Ensure: • Drive Enable signal is not given (terminal 31) • Run signal is not given • Motor connected • Tacho connected if one is being used • Encoder connected if one is being used	
Power-up the drive	Ensure: • Drive displays 'inh' **NOTE** The drive will trip 'th' (Motor thermistor trip) if no motor thermistor is connected to analog input 3 (terminal 8). If the motor protection is not connected to the drive, the 'th' trip can be disabled by setting Pr **7.15** (**in01**, **0.81**) (analog input 3 mode) to VOLt. For drive trips, see Chapter 9 *Diagnostics* on page 107.	
Enter motor nameplate details	Enter: • Armature rated voltage in Pr **5.09** (**SE06, 0.27**) (V) • Motor rated current in Pr **5.07** (**SE07, 0.28**) (A) • Motor rated speed (base speed) in Pr **5.08** (**SE08, 0.29**) (rpm) • Field rated current in Pr **5.70** (**SE10, 0.31**) (A) • Field rated voltage in Pr **5.73** (**SE11, 0.32**) (V)	
Set motor feedback parameters	**Incremental encoder basic set-up** Enter: • Drive encoder type in Pr **3.38** (**Fb07, 0.77**) = Ab (0): Quadrature encoder **CAUTION** Setting the encoder voltage supply too high for the encoder could result in damage to the feedback device • Encoder power supply in Pr **3.36** (**Fb06, 0.76**) = 5V (0), 8V (1), 15V (2) or 24V (3) **NOTE** If output voltage from the encoder is >5V, then the termination resistors must be disabled Pr **3.39** (**Fb08, 0.78**) to 0. • Drive encoder lines per revolution (LPR) in Pr **3.34** (**Fb05, 0.75**) (set according to encoder) • Drive encoder termination resistor setting in Pr **3.39** (**Fb08, 0.78**) **0** = A-A\, B-B\, Z-Z\ termination resistors disabled **1** = A-A\, B-B\, termination resistors enabled, Z-Z\ termination resistors disabled **2** = A-A\, B-B\, Z-Z\ termination resistors enabled **Tachometer set-up** Enter: • Tachometer voltage rating Pr **3.51** (**Fb02, 0.72**) (V/1000 rpm) • Tachometer input mode Pr **3.53** (**Fb03, 0.73**)	
Set maximum speed	Enter: • Maximum speed in Pr **1.06** (**SE02, 0.23**) (rpm) • Set Pr **5.64** = On If field weakening is required **NOTE** For field weakening in Estimated Speed Mode please refer to the *Mentor MP User Guide - Chapter 8 Optimization - Field current*.	

Action	Detail	
Set acceleration / deceleration rates	Enter: • Acceleration rate in Pr **2.11** (**SE03, 0.24**) (time to accelerate to maximum speed) • Deceleration rate in Pr **2.21** (**SE04, 0.25**) (time to decelerate from maximum speed)	
Enable the field controller	**Field controller set-up** • Select field mode by setting Pr **5.78** = IntrnL (Internal field controller is used), Etrnl (External half control), E FULL (External in full control). • Set Pr **5.77** (**SE12**, **0.33**) = On to enable the field.	
Static autotune	Mentor MP is able to perform either a static, rotating or continuous autotune. The motor must be at a standstill before an autotune is enabled. **Static autotune for current loop gains** When this operation is performed the drive will perform an estimation of *Motor constant* (Pr **5.15**), *Continuous proportional gain* (Pr **4.13**), *Continuous integral gain* (Pr **4.14**), *Discontinuous integral gain* (Pr **4.34**), *Back EMF set point* (Pr **5.59**), *Armature resistance* (Pr **5.61**) and *Flux loop I gain* (Pr **5.72**) with respect to the selected motor map and store the values. To perform a static autotune: • Set Pr **5.12** (**SE12, 0.33**)= 1 • Close the Drive Enable signal (terminal 31). The drive will display 'rdY' • Close the run signal (terminal 26 or 27). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the autotune • Remove the enable signal when the autotune has finished • Remove the run signal	
Checking speed feedback	• Close the enable signal. Close the run signal (terminal 26 or 27). Provide speed reference to run the drive up to a low speed, the drive will regulate its own estimated speed. • Check that the feedback device is functioning correctly: For encoder speed feedback - Check encoder speed feedback Pr **3.27** (**Fb09, 0.79**). For tachometer speed feedback - Check tachometer speed feedback Pr **3.52** (**Fb04, 0.74**). • When the feedback device being used is seen to be functioning correctly, stop the drive and select the correct feedback device using Pr **3.26** (**Fb01,** Pr **0.71**) **NOTE** For improved estimated speed accuracy and torque control in the field weakening range a rotating autotune is recommended to determine the motor flux characteristics Pr **5.12** (**SE13**, **0.34**) = 2	

Action	Detail	
Rotating autotune	Mentor MP is able to perform either a static, rotating or continuous autotune. The motor must be at a standstill before an autotune is enabled. **NOTE** A rotating autotune cannot be carried out in Estimated speed mode. **WARNING** A rotating autotune will cause the motor to accelerate up to $^1/_4$ base speed in the direction selected regardless of the reference provided. Once complete the motor will coast to a stop. The enable signal must be removed before the drive can be made to run at the required reference. The drive can be stopped at any time by removing the run signal or removing the drive enable. **Rotating autotune for motor field flux set-up** When selected the drive will determine the *Rated field compensation factor* (Pr **5.74**) for rated flux and the motor field winding saturation break-points (Pr **5.29** and Pr **5.30**), by spinning the motor at 25% of its base speed (Pr **5.08**) with respect to the selected motor map and store the values. To perform an autotune: • Set Pr **5.12** (**SE13, 0.34**) = 2 for a rotating autotune • Close the Drive Enable signal (terminal 31). The drive will display 'rdY' • Close the run signal (terminal 26 or 27). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the autotune • Wait for the drive to display 'inh' and for the motor to come to a standstill If the drive trips, see Chapter 9 *Diagnostics* on page 107. • Remove the drive enable and run signal from the drive.	
Save parameters	Select SAVE in Pr **xx.00** (**SE00, 0.21**) Press the red reset button or toggle the reset digital input (ensure Pr **xx.00** (**SE00, 0.21**) returns to 'no Act').	
Run	Drive is now ready to run • Close enable signal • Close run signal • Provide speed reference	

6.2 Quick start commissioning / start-up (from USA defaults)

Action	Detail	
Before power-up	Ensure: • Drive Enable signal is not given (terminal 31) • Run signal is not given • Motor connected • Tacho connected if one is being used • Encoder connected if one is being used	
Power-up the drive	Ensure: • Drive displays 'inh' **NOTE** Motor thermistor input is disabled by default. If motor thermistor is available the thermistor should be used. The protection is enabled with Pr **7.15** (**in01**, **0.81**). For drive trips, see Chapter 9 *Diagnostics* on page 107.	
Enter motor nameplate details	Enter: • Armature rated voltage in Pr **5.09** (**SE06, 0.27**) (V) • Motor rated current in Pr **5.07** (**SE07, 0.28**) (A) • Motor rated speed (base speed) in Pr **5.08** (**SE08, 0.29**) (rpm) • Field rated voltage in Pr **5.73** (**SE11, 0.32**) (V)	
Set motor feedback parameters	**Incremental encoder basic set-up** Enter: • Drive encoder type in Pr **3.38** (**Fb07, 0.77**) = Ab (0): Quadrature encoder **CAUTION** Setting the encoder voltage supply too high for the encoder could result in damage to the feedback device. • Encoder power supply in Pr **3.36** (**Fb06, 0.76**) = 5V (0), 8V (1), 15V (2) or 24V (3) **NOTE** If output voltage from the encoder is >5V, then the termination resistors must be disabled Pr **3.39** (**Fb08, 0.78**) to 0. • Drive encoder lines per revolution (LPR) in Pr **3.34** (**Fb05, 0.75**) (set according to encoder) • Drive encoder termination resistor setting in Pr **3.39** (**Fb08, 0.78**) **0** = A-A\, B-B\, Z-Z\ termination resistors disabled **1** = A-A\, B-B\, termination resistors enabled, Z-Z\ termination resistors disabled **2** = A-A\, B-B\, Z-Z\ termination resistors enabled **Tachometer set-up** Enter: • Tachometer voltage rating Pr **3.51** (**Fb02, 0.72**) (V/1000 rpm) • Tachometer input mode Pr **3.53** (**Fb03, 0.73**)	
Set maximum speed	Enter: • Maximum speed in Pr **1.06** (**SE02, 0.23**) (rpm) **NOTE** For field weakening the field controller needs to be setup in current control by setting Pr **5.75** = OFF, setting the rated field current into **5.70** (**SE10, 0.31**) and setting Pr **5.64** to On. For field weakening in Estimated Speed Mode please refer to the *Mentor MP User Guide - Chapter 8 Optimization - Field current*.	

Action	Detail	
Set acceleration / deceleration rates	Enter: • Acceleration rate in Pr **2.11** (**SE03, 0.24**) (time to accelerate to maximum speed) • Deceleration rate in Pr **2.21** (**SE04, 0.25**) (time to decelerate from minimum speed)	
Enable the field controller	**Field controller set-up** • Select field mode by setting Pr **5.78** = IntrnL (Internal field controller is used), Etrnl (External half control), E FULL (External in full control). • Set Pr **5.77** (**SE12**, **0.33**) = On to enable the field.	
Static autotune	Mentor MP is able to perform either a static, rotating or continuous autotune. The motor must be at a standstill before an autotune is enabled. **Static autotune for current loop gains** When this operation is performed the drive will perform an estimation of *Motor constant* (Pr **5.15**), *Continuous proportional gain* (Pr **4.13**), *Continuous integral gain* (Pr **4.14**), *Discontinuous integral gain* (Pr **4.34**), *Back EMF set point* (Pr **5.59**), *Armature resistance* (Pr **5.61**) and *Flux loop I gain* (Pr **5.72**) with respect to the selected motor map and store the values. To perform a static autotune: • Set Pr **5.12** (**SE13, 0.34**)= 1 • Close the Drive Enable signal (terminal 31). The drive will display 'rdY' • Close the run signal (terminal 26 or 27). The lower display will flash 'Auto' and 'tunE' alternatively, while the drive is performing the autotune • Remove the enable signal when the autotune has finished • Remove the run signal **NOTE** A rotating autotune Pr **5.12** (**SE13**, **0.34**) = 2 should not be carried out when the field controller is in voltage mode, Pr **5.75** = On (USA default).	
Checking speed feedback	• Close the enable signal. Close the run signal (terminal 26 or 27). Provide speed reference to run the drive up to a low speed, the drive will regulate its own estimated speed. • Check that the feedback device is functioning correctly: For encoder speed feedback - Check encoder speed feedback Pr **3.27** (**Fb09, 0.79**). For tachometer speed feedback - Check tachometer speed feedback Pr **3.52** (**Fb04, 0.74**). • When the feedback device being used is seen to be functioning correctly, stop the drive and select the correct feedback device using Pr **3.26** (**Fb01,** Pr **0.71**).	
Save parameters	Select SAVE in Pr **xx.00** (**SE00, 0.21**) Press the red reset button or toggle the reset digital input (ensure Pr **xx.00** (**SE00, 0.21**) returns to 'no Act').	
Run	Drive is now ready to run • Close enable signal • Close run signal • Provide speed reference	

7 SMARTCARD operation

7.1 Introduction

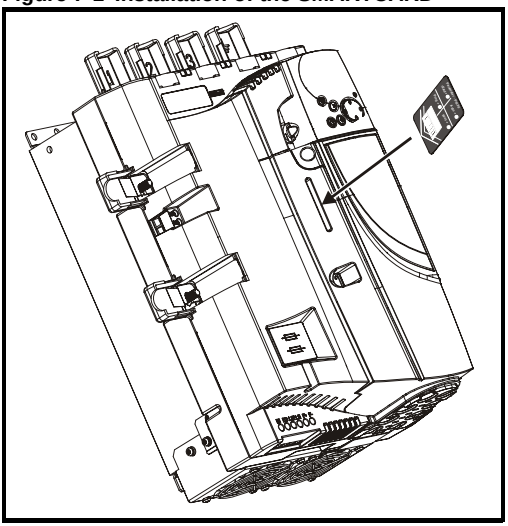
This is a standard feature that enables simple configuration of parameters in a variety of ways. The SMARTCARD can be used for:

- Parameter copying between drives
- Saving whole drive parameter sets
- Saving ‘differences from default’ parameter sets
- Storing Onboard PLC programs
- Automatically saving all user parameter changes for maintenance purposes
- Loading complete motor map parameters.

Refer to Figure 7-1 for installing the SMARTCARD. Ensure the SMARTCARD is inserted with the MP arrow pointing upwards.

The drive only communicates with the SMARTCARD when commanded to read or write, this means that the card may be ‘hot swapped’.

Figure 7-1 Installation of the SMARTCARD



7.2 Easy saving and reading

The SMARTCARD has 999 individual data block locations. Each individual location from 1 to 499 can be used to store data.

The drive can support SMARTCARDS that have a capacity of between 4kB and 512kB.

The usage of the data block locations in the SMARTCARD are shown in Table 7-1.

Table 7-1 SMARTCARD data blocks

Data block	Type	Example of usage
1 to 499	Read / Write	Application set-up
500 to 999	Read Only	Macros

Parameter sets labelled as ‘Differences from default‘ will be much smaller than whole parameter sets. Therefore they use a lot less memory because most applications only

require a few parameters to be changed from the default setting.

Either of these indications will tell the user that data is being transferred to or from the SMARTCARD:

- SM-Keypad: The decimal point after the fourth digit in the upper display will flash.
- MP-Keypad: The symbol 'CC' will appear in the lower left hand corner of the display.

The card should not be removed during data transfer because the drive will trip. If a trip occurs you must either try to transfer the data again or, in the case of a card-to-drive transfer, the default parameters should be loaded.

7.3 Transferring data

When a code is entered into Pr **xx.00** and the drive is subsequently reset, the drive will carry out the actions listed in Table 7-2.

Table 7-2 Transferring data

Codes	Actions
Pr **x.00** = rEAd 1	Transfer SMARTCARD data block 1 to the drive.
Pr **x.00** = rEAd 2	Transfer SMARTCARD data block 2 to the drive.
Pr **x.00** = rEAd 3	Transfer SMARTCARD data block 3 to the drive.
Pr **x.00** = PrOg 1	Transfer drive parameters as difference from default to SMARTCARD data block number 1.
Pr **x.00** = PrOg 2	Transfer drive parameters as difference from default to SMARTCARD data block number 2.
Pr **x.00** = PrOg 3	Transfer drive parameters as difference from default to SMARTCARD data block number 3.
Pr **x.00** = 2001	Transfer drive parameters as difference from defaults to a bootable SMARTCARD data block with block number 1. This will clear data block 1 on the card if it already exists.
Pr **x.00**= 3yyy	Transfer drive parameters to a SMARTCARD data block number yyy.
Pr **x.00** = 4yyy	Transfer drive data as difference from defaults to SMARTCARD data block number yyy.
Pr **x.00**= 5yyy	Transfer drive user program to SMARTCARD data block number yyy.
Pr **x.00** = 6yyy	Transfer SMARTCARD data block yyy to the drive.
Pr **x.00** = 7yyy	Erase SMARTCARD data block yyy.
Pr **x.00** = 8yyy	Compare drive parameters with data block yyy.
Pr **x.00** = 9555	Clear SMARTCARD warning suppression flag.
Pr **x.00** = 9666	Set SMARTCARD warning suppression flag.
Pr **x.00**= 9777	Clear SMARTCARD read-only flag.
Pr **x.00** = 9888	Set SMARTCARD read-only flag.
Pr **x.00** = 9999	Erase SMARTCARD.
Pr **11.42** (**SE09, 0.30**) = Read	Transfer SMARTCARD data block 1 to the drive provided it is a parameter file.
Pr **11.42** (**SE09, 0.30**) = Prog	Transfer drive parameters to a SMARTCARD data block number 1.
Pr **11.42** (**SE09, 0.30**) = Auto	Transfer drive parameters to a SMARTCARD data block with data block number 1 provided.
Pr **11.42** (**SE09, 0.30**) = boot	Pr **11.42** (**SE09, 0.30**) has been changed since power-up.

Where yyy indicates the data block number 001 to 999, refer to Table 7-1 for restrictions on data block numbers.

NOTE

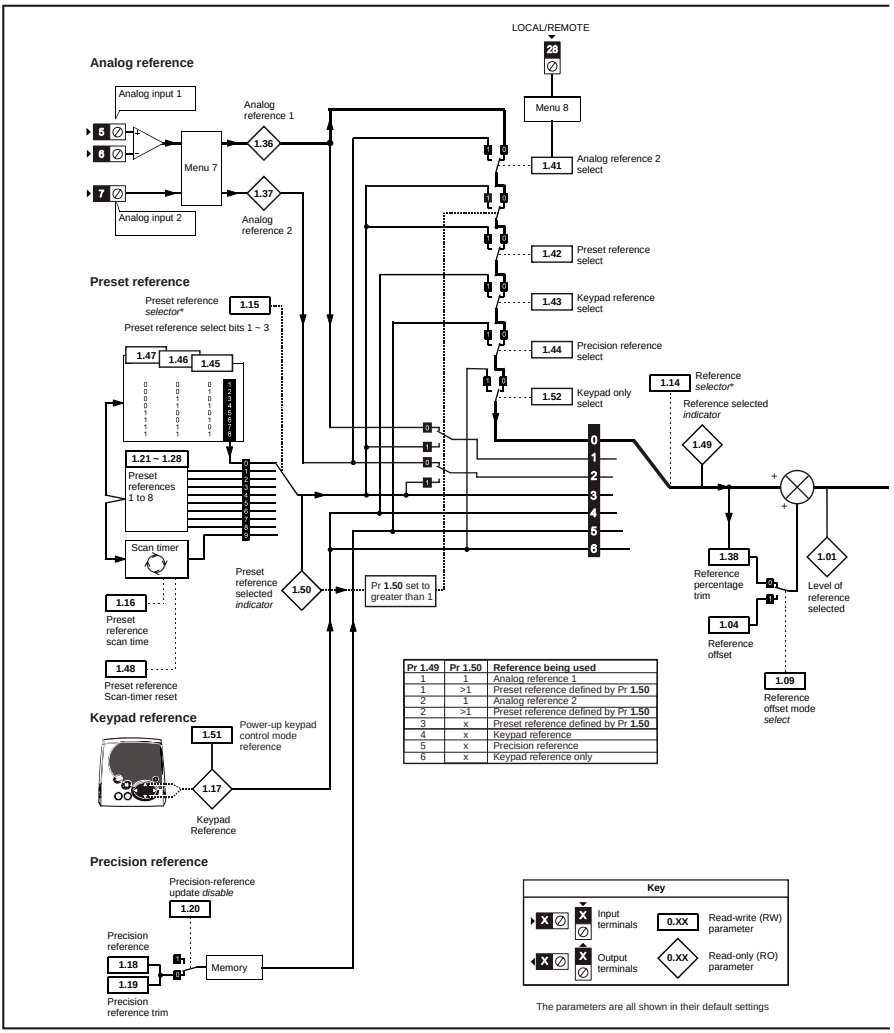
If the read only flag is set then only codes 6yyy or 9777 are effective.

8 Advanced parameters

8.1 Menu 1: Speed reference

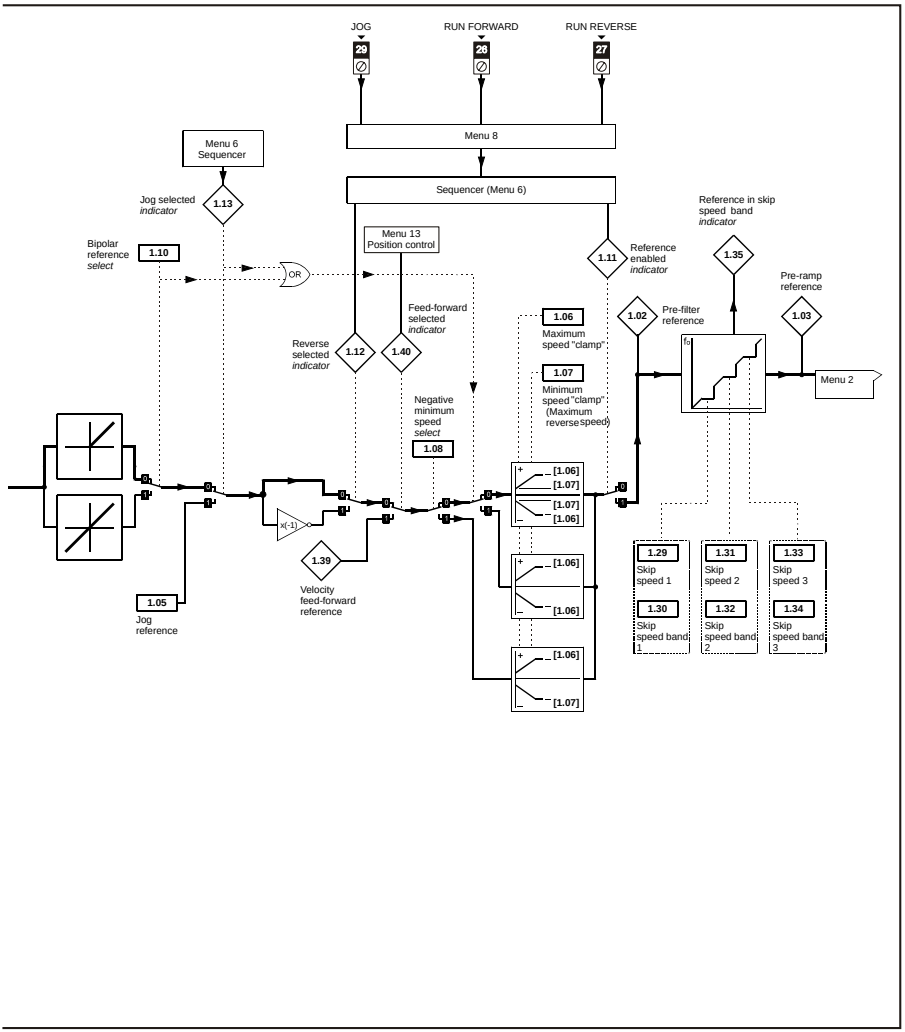
Menu 1 controls the main reference selection.

Figure 8-1 Menu 1 logic diagram



Pr 1.49	Pr 1.50	Reference being used
1	1	Analog reference 1
1	>1	Preset reference defined by Pr **1.50**
2	1	Analog reference 2
2	>1	Preset reference defined by Pr **1.50**
3	x	Preset reference defined by Pr **1.50**
4	x	Keypad reference
5	x	Precision reference
6	x	Keypad reference only

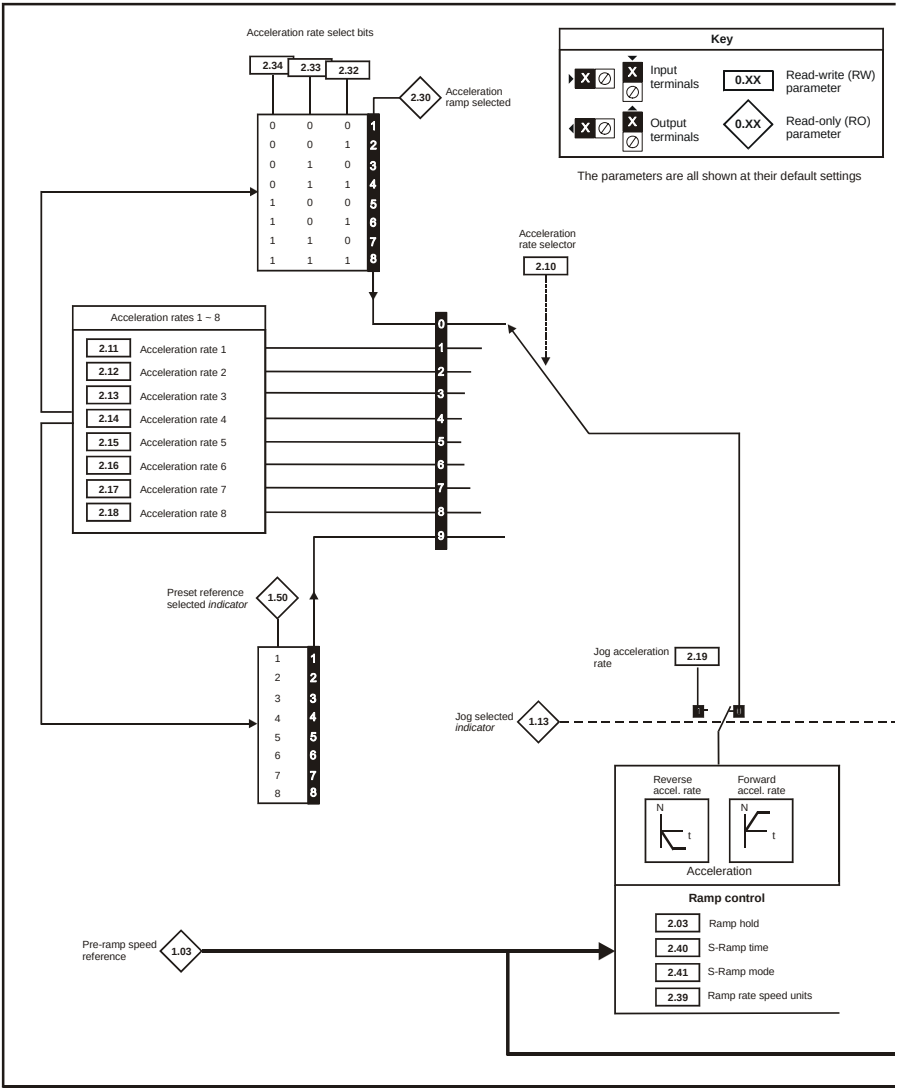
*Refer to Pr **1.14** (**SE05**, **0.26**).

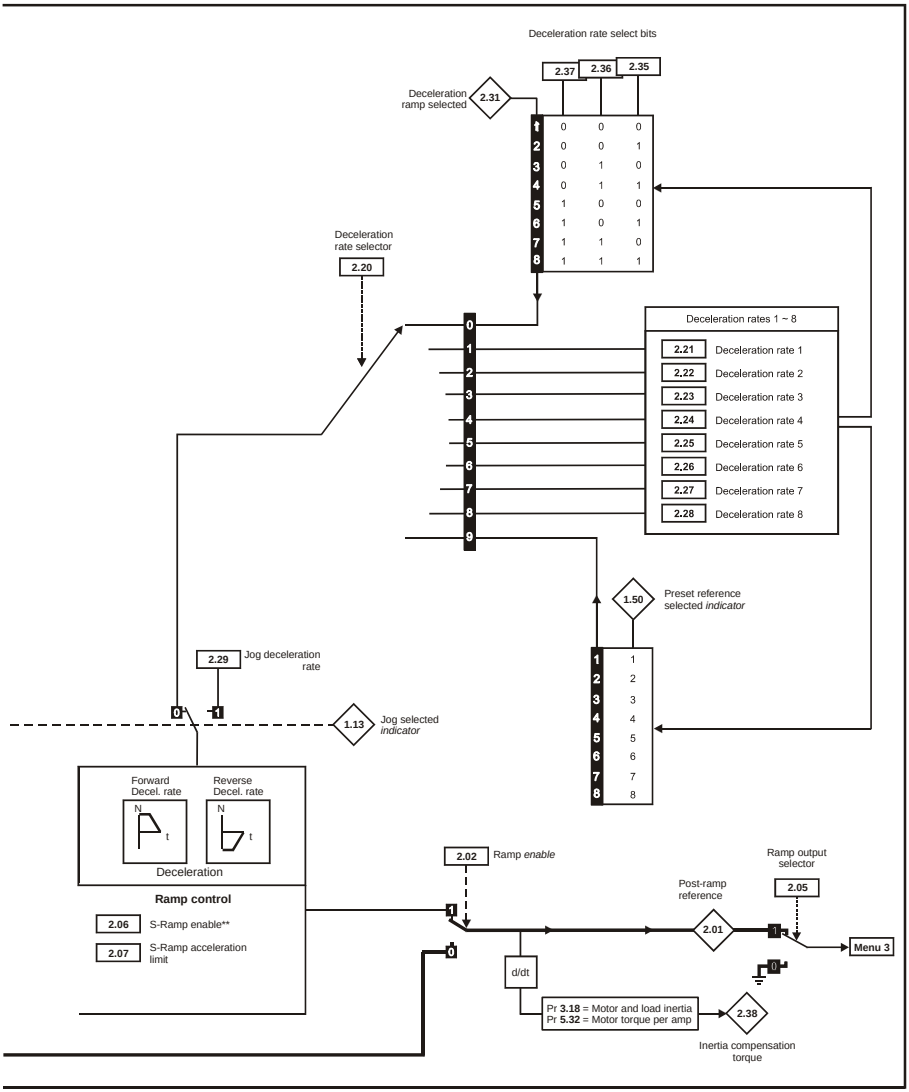

JOG
RUN FORWARD
RUN REVERSE
28
26
27
Menu 8
Menu 6 Sequencer
Sequencer (Menu 6)
Jog selected indicator
1.13
Menu 13 Position control
Reference in skip speed band indicator
Bipolar reference select
1.10
OR
1.11
Reference enabled indicator
1.35
Pre-ramp reference
1.03
Feed-forward selected indicator
1.06
Maximum speed "clamp"
1.02
Pre-filter reference
Reverse selected indicator
1.12
1.40
1.07
Minimum speed "clamp" (Maximum reverse speed)
Menu 2
Negative minimum speed select
1.08
[1.06]
[1.07]
[1.07]
[1.06]
x(-1)
1.39
Velocity feed-forward reference
[1.06]
[1.06]
[1.06]
[1.07]
1.05
Jog reference
1.29
Skip speed 1
1.30
Skip speed band 1
1.31
Skip speed 2
1.32
Skip speed band 2
1.33
Skip speed 3
1.34
Skip speed band 3

8.2 Menu 2: Ramps

The pre-ramp speed reference passes through the ramp block controlled by menu 2 before being used by the drive to produce input to the speed controller. The ramp block includes: linear ramps, and an S ramp function for ramped acceleration and deceleration.

Figure 8-2 Menu 2 logic diagram





** For more information refer to the ‘Advanced parameters’ section in the *Mentor MP User Guide.*

8.3 Menu 3: Speed feedback and speed control

Speed accuracy and resolution

Digital reference resolution

When a preset speed is used the reference resolution is 0.1rpm. Improved resolution can be obtained by using the precision reference (0.001rpm).

Analog reference resolution

The analog input has a maximum resolution of 14bits plus sign. The resolution of the reference from analog inputs 2 or 3 is 10bits plus sign.

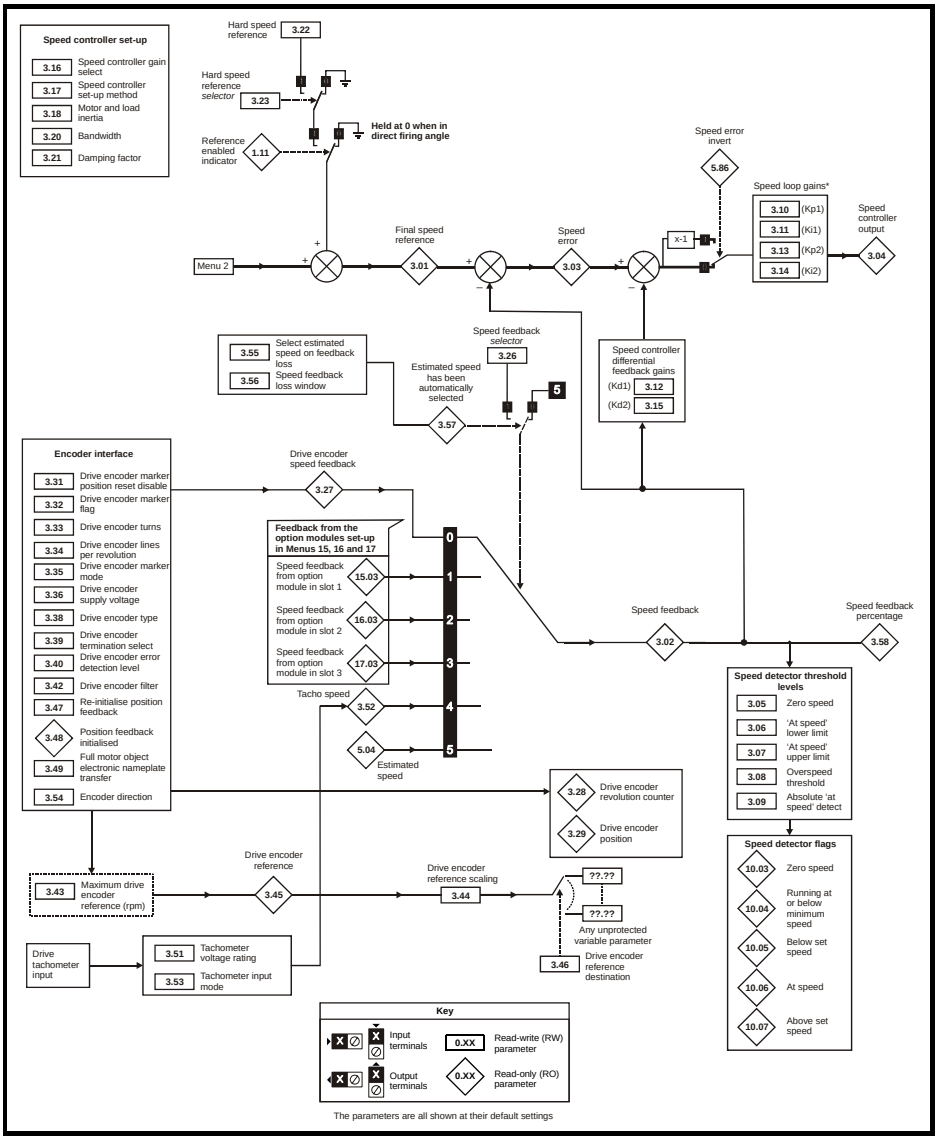
Analog feedback resolution

The resolution for both Armature voltage and tachogenerator feedback is 10bit plus sign.

Accuracy

With encoder feedback the absolute speed accuracy depends on the accuracy of the crystal used with the drive microprocessor. The accuracy of the crystal is 100ppm, and so the absolute speed accuracy is 100ppm (0.01%) of the reference, when a preset speed is used. If an analog input is used the absolute accuracy is further limited by the absolute accuracy and non-linearity of the analog input. If analog feedback is used the accuracy is even further limited.

Figure 8-3 Menu 3 logic diagram


Speed controller set-up
3.16 Speed controller gain select
3.17 Speed controller set-up method
3.18 Motor and load inertia
3.20 Bandwidth
3.21 Damping factor
Hard speed reference 3.22
Hard speed reference selector 3.23
Reference enabled indicator 1.11
Held at 0 when in direct firing angle
Menu 2
Final speed reference 3.01
Speed error 3.03
Speed error invert 5.86
x-1
Speed loop gains* 3.10 (Kp1) 3.11 (Ki1) 3.13 (Kp2) 3.14 (Ki2)
Speed controller output 3.04
Speed feedback selector 3.26
Estimated speed has been automatically selected 3.57
3.55 Select estimated speed on feedback loss
3.56 Speed feedback loss window
Speed controller differential feedback gains (Kd1) 3.12 (Kd2) 3.15
Encoder interface
3.31 Drive encoder marker position reset disable
3.32 Drive encoder marker flag
3.33 Drive encoder turns
3.34 Drive encoder lines per revolution
3.35 Drive encoder marker mode
3.36 Drive encoder supply voltage
3.38 Drive encoder type
3.39 Drive encoder termination select
3.40 Drive encoder error detection level
3.42 Drive encoder filter
3.47 Re-initialise position feedback
3.48 Position feedback initialised
3.49 Full motor object electronic nameplate transfer
3.54 Encoder direction
Drive encoder speed feedback 3.27
Feedback from the option modules set-up in Menus 15, 16 and 17
Speed feedback from option module in slot 1 15.03
Speed feedback from option module in slot 2 16.03
Speed feedback from option module in slot 3 17.03
Tacho speed 3.52
Estimated speed 5.04
Speed feedback 3.02
Speed feedback percentage 3.58
Speed detector threshold levels
3.05 Zero speed
3.06 'At speed' lower limit
3.07 'At speed' upper limit
3.08 Overspeed threshold
3.09 Absolute 'at speed' detect
Speed detector flags
10.03 Zero speed
10.04 Running at or below minimum speed
10.05 Below set speed
10.06 At speed
10.07 Above set speed
3.28 Drive encoder revolution counter
3.29 Drive encoder position
Drive encoder reference 3.45
3.43 Maximum drive encoder reference (rpm)
Drive encoder reference scaling 3.44
??.??
??.??
Any unprotected variable parameter
3.46 Drive encoder reference destination
Drive tachometer input
3.51 Tachometer voltage rating
3.53 Tachometer input mode
Key
Input terminals
Output terminals
0.XX Read-write (RW) parameter
0.XX Read-only (RO) parameter
The parameters are all shown at their default settings

* If Pr **5.28** (Field weakening compensation disable) is set to 'OFF (0)' a multiplication factor is applied to the speed loop gains when the flux is below 100%.

8.4 Menu 4: Torque and current control

MOTOR1_CURRENT_LIMIT_MAX is used as the maximum for some parameters such as the user current limits. The current maximum current limit is defined as follows (with a maximum of 1000%):

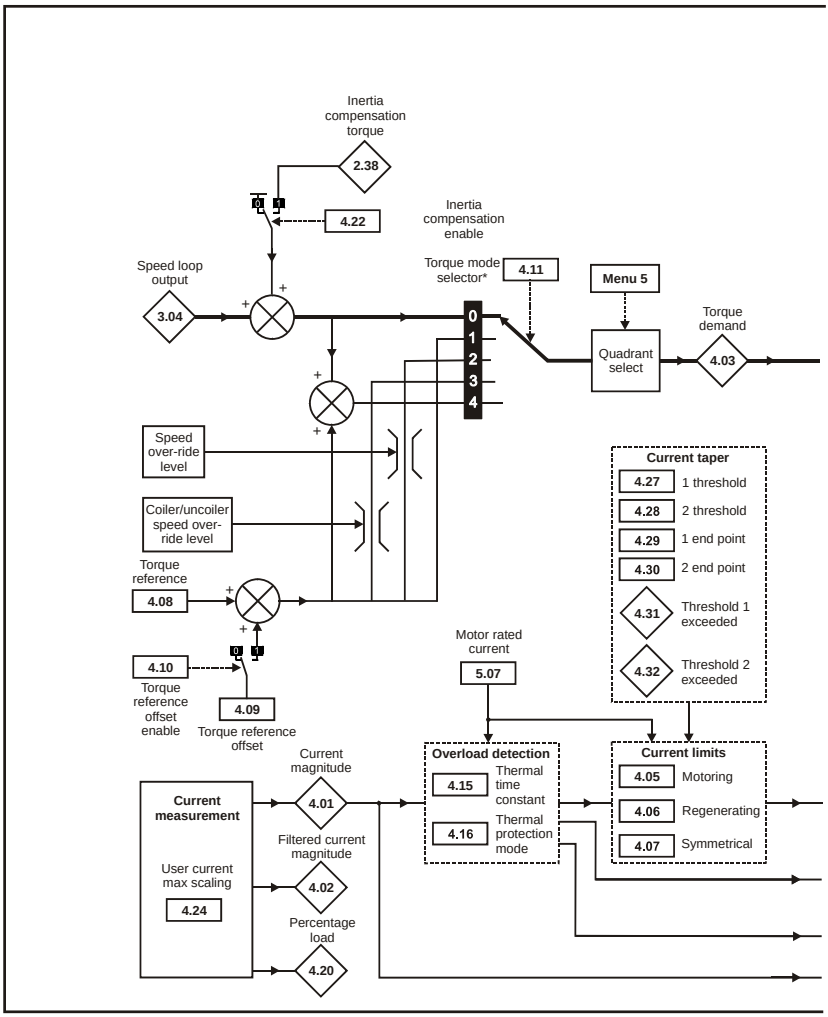
$$\textbf{CURRENT\_LIMIT\_MAX} = \left[\frac{\textbf{Maximum current}}{\textbf{Motor rated current}}\right] \times \textbf{100\%}$$

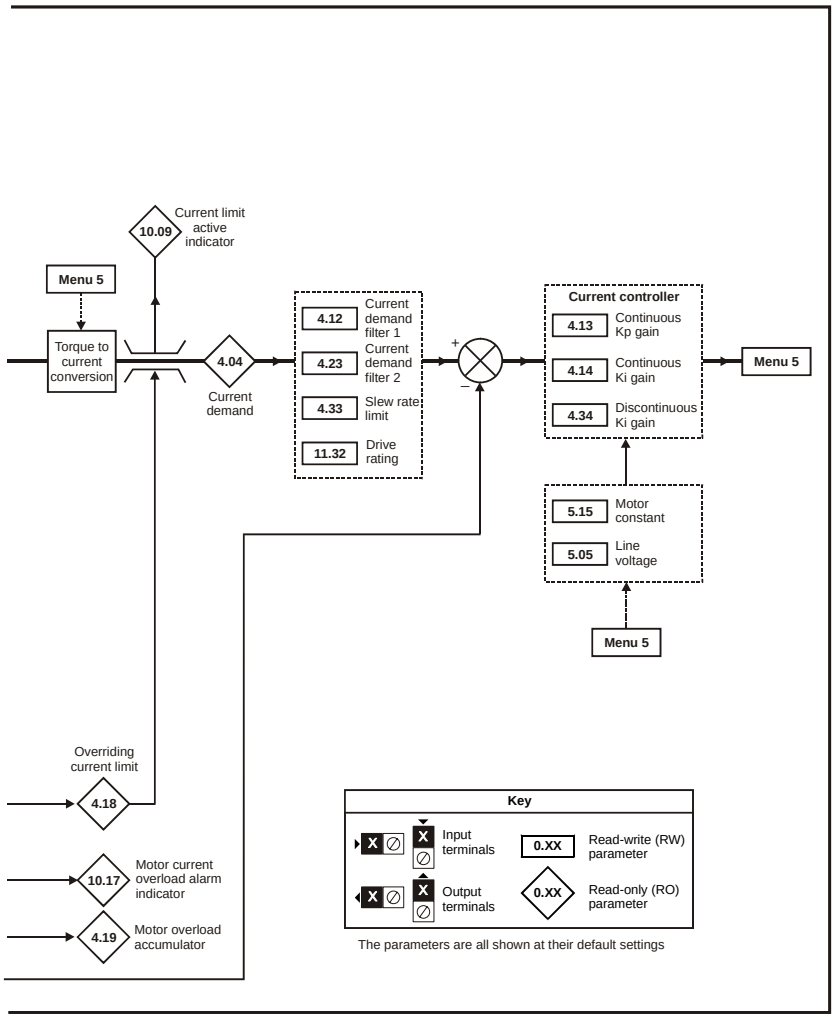
Where:

Motor rated current is given by Pr **5.07** (**SE07**, **0.28**).

(MOTOR2_CURRENT_LIMIT_MAX is calculated from the motor map 2 parameters). The maximum current is 1.5 x drive rating.

Figure 8-4 Menu 4 logic diagram





The parameters are all shown at their default settings

8.5 Menu 5: Motor and field control

Figure 8-5 Menu 5 armature control logic diagram

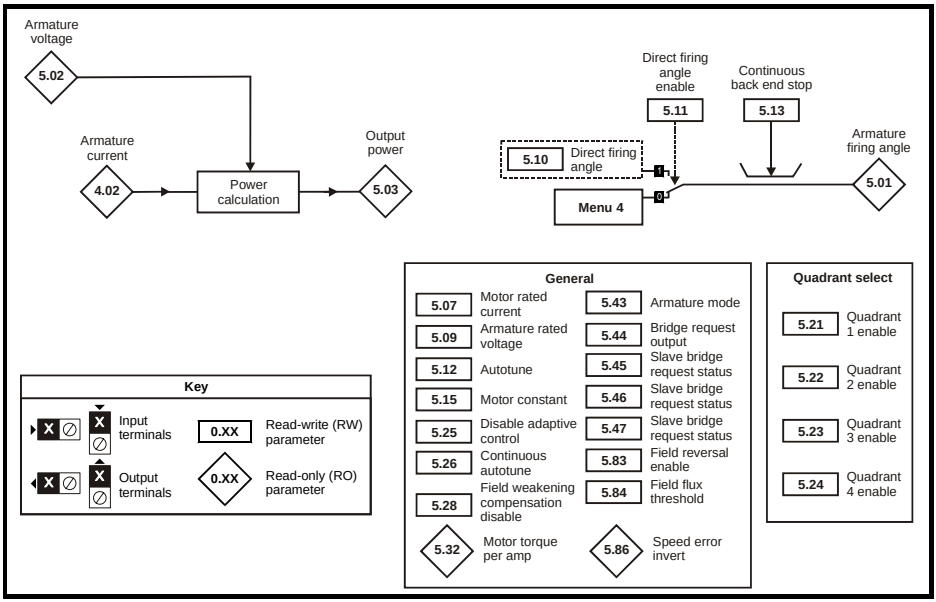
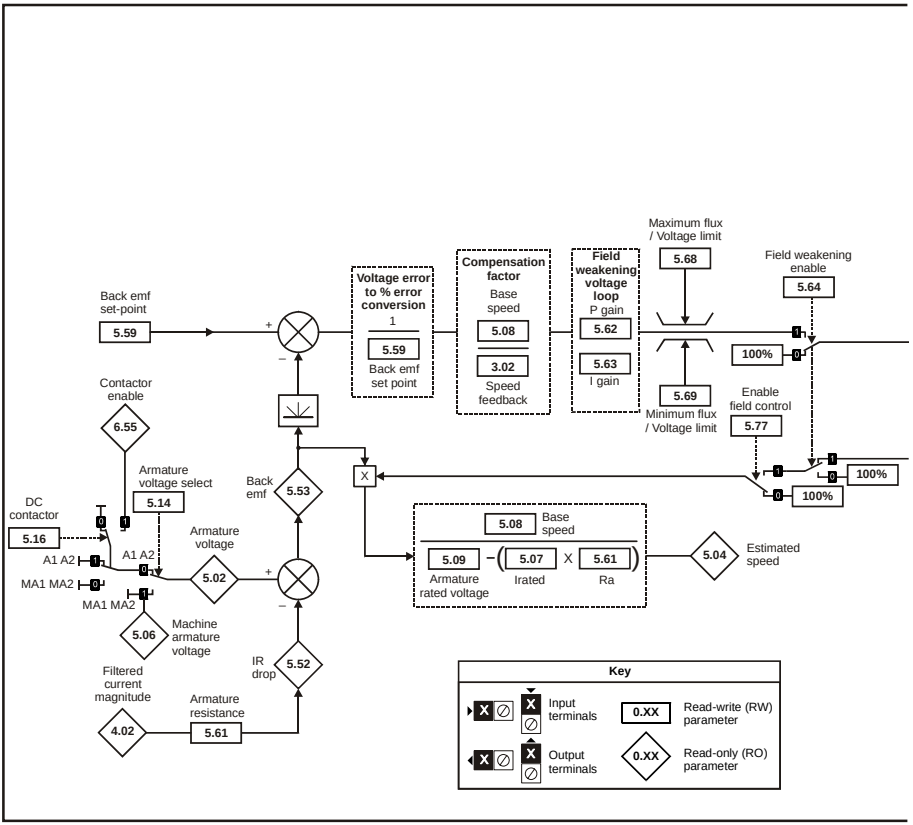
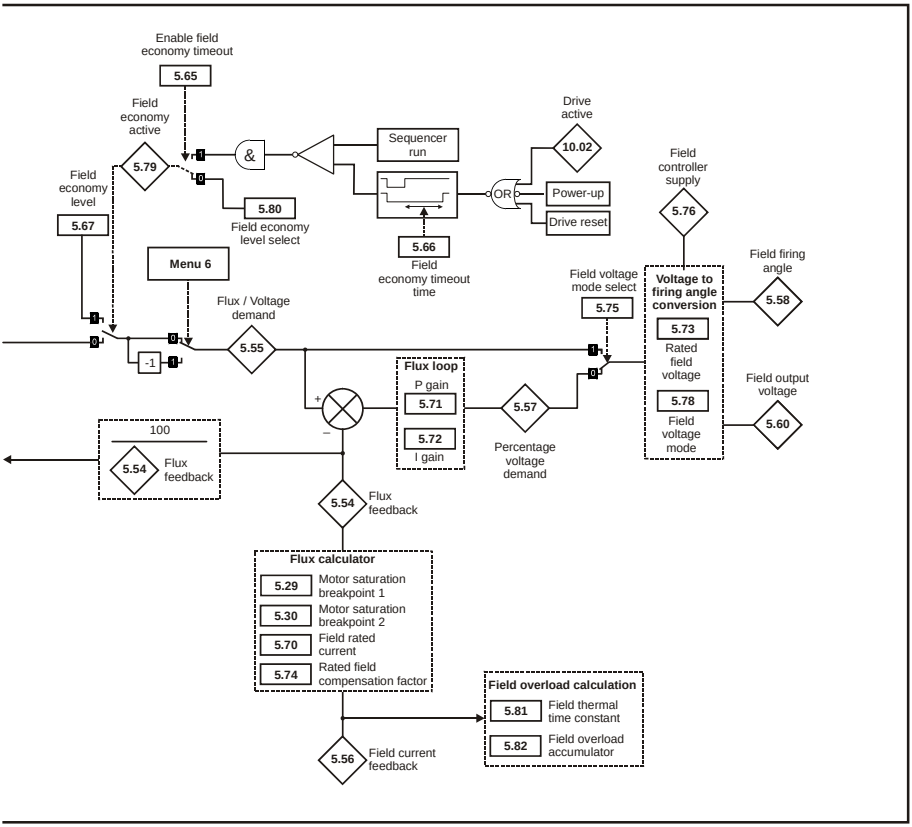


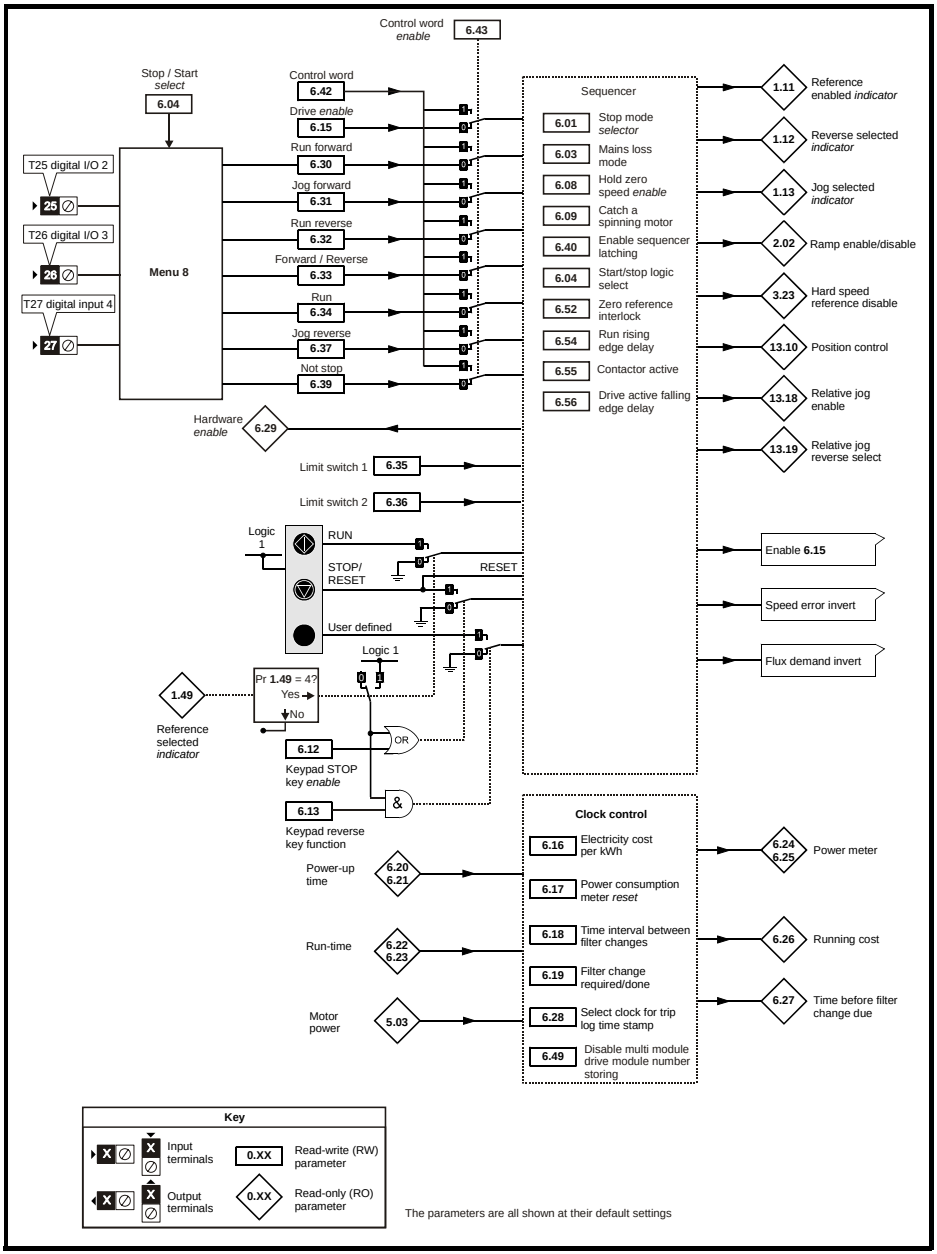
Figure 8-6 Menu 5 field control logic diagram




Enable field economy timeout
5.65
Field economy active
5.79
Field economy level
5.67
5.80
Field economy level select
&
Sequencer run
OR
Drive active
10.02
Power-up
Drive reset
5.66
Field economy timeout time
Field controller supply
5.76
Field firing angle
5.58
Menu 6
Flux / Voltage demand
5.55
-1
Field voltage mode select
5.75
Voltage to firing angle conversion
5.73
Rated field voltage
5.78
Field voltage mode
Field output voltage
5.60
Flux loop
P gain
5.71
5.72
I gain
5.57
Percentage voltage demand
100
5.54
Flux feedback
Flux calculator
5.29
Motor saturation breakpoint 1
5.30
Motor saturation breakpoint 2
5.70
Field rated current
5.74
Rated field compensation factor
Field overload calculation
5.81
Field thermal time constant
5.82
Field overload accumulator
5.56
Field current feedback

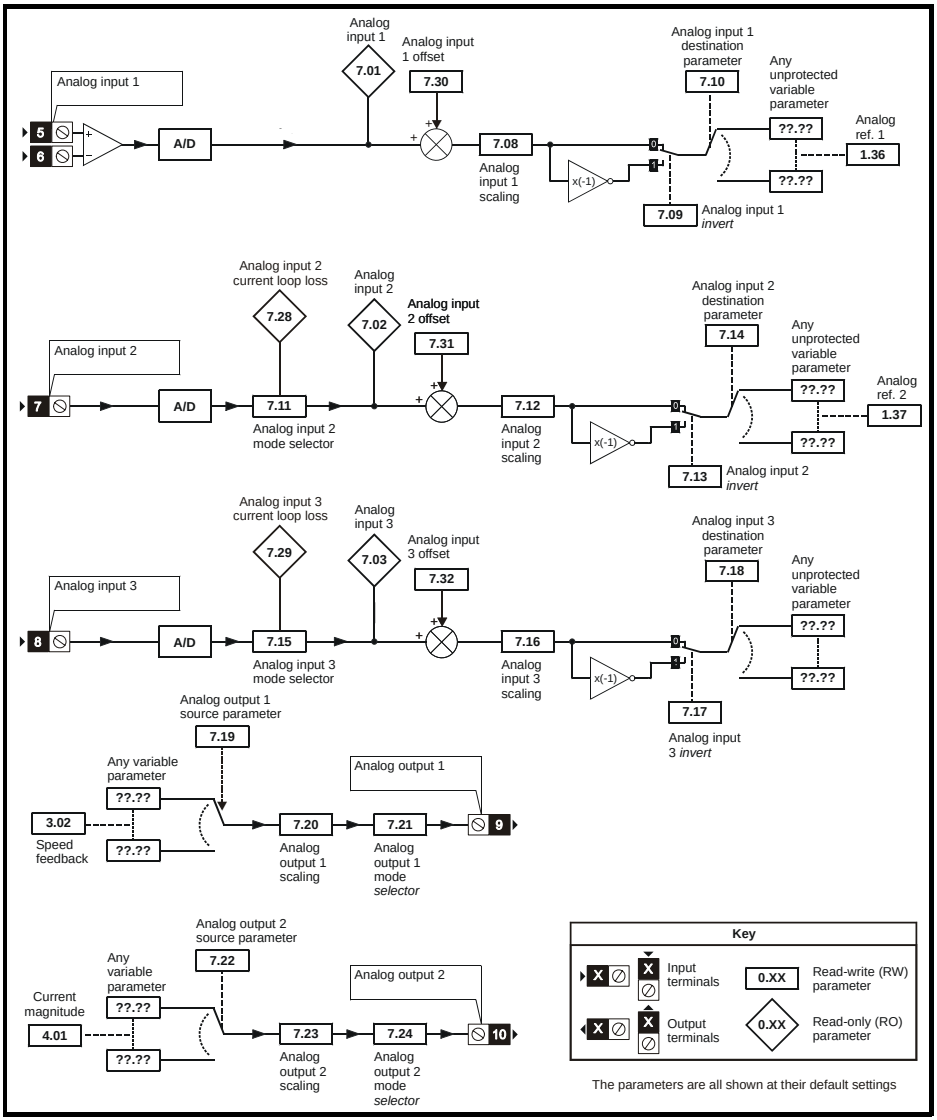
8.6 Menu 6: Sequencer and clock

Figure 8-7 Menu 6 logic diagram



8.7 Menu 7: Analog I/O

Figure 8-8 Menu 7 logic diagram



The parameters are all shown at their default settings

8.8 Menu 8: Digital I/O

Figure 8-9 Menu 8 logic diagram

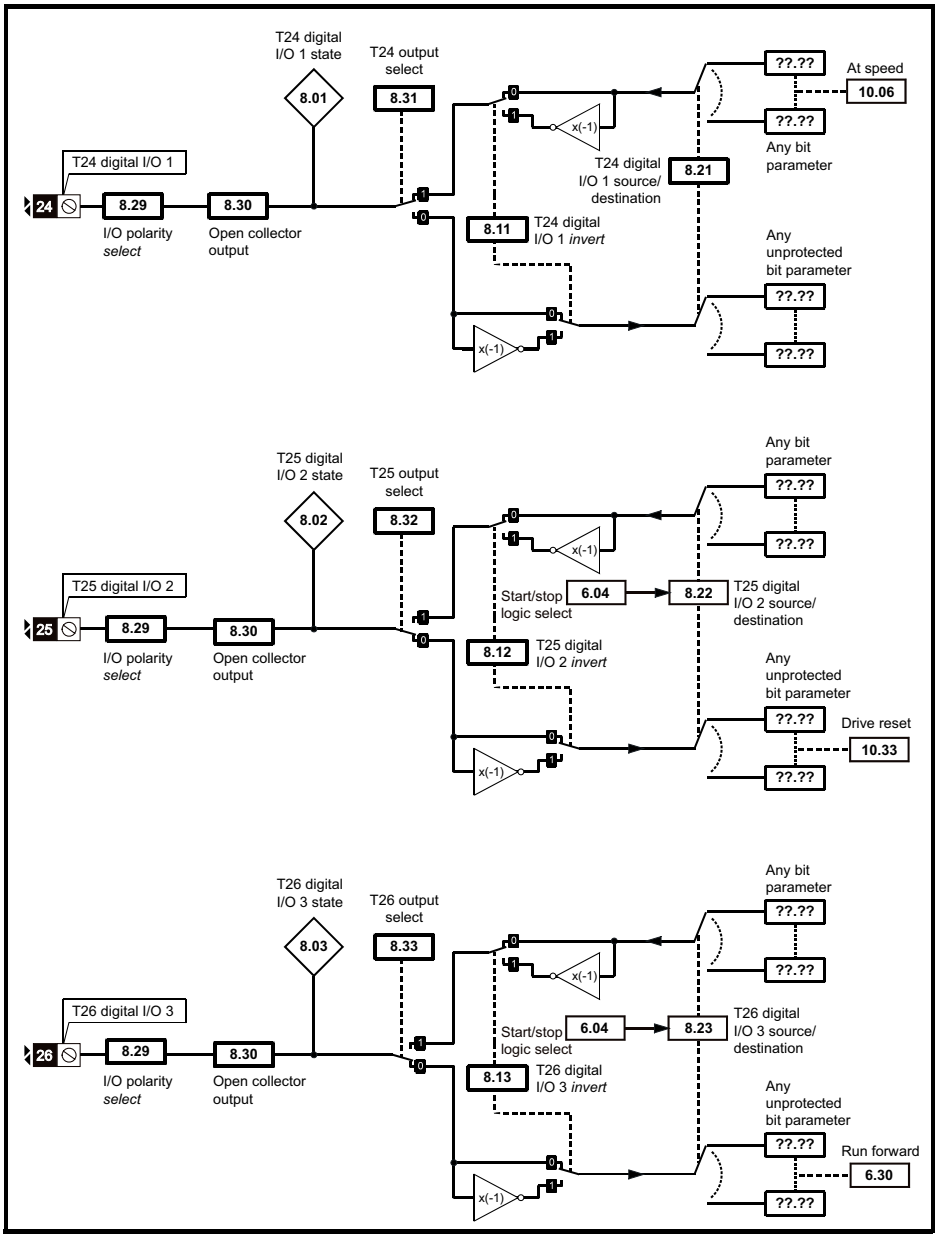


Figure 8-10 Menu 8 logic diagram (cont)

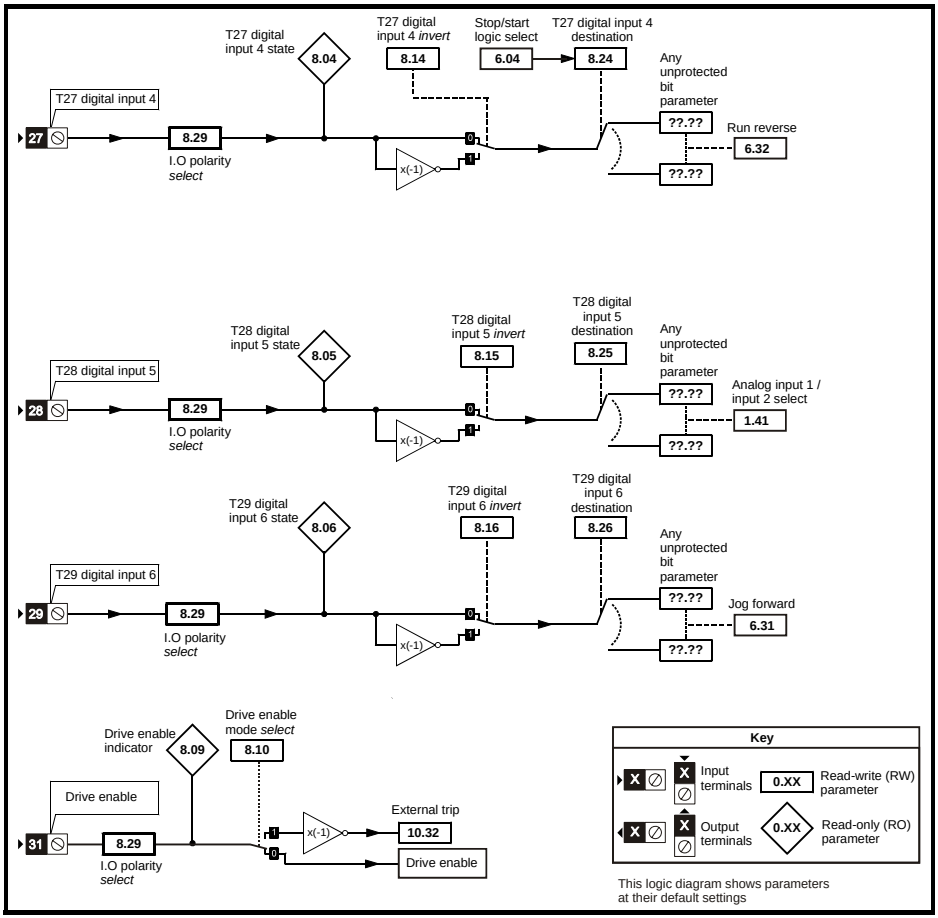
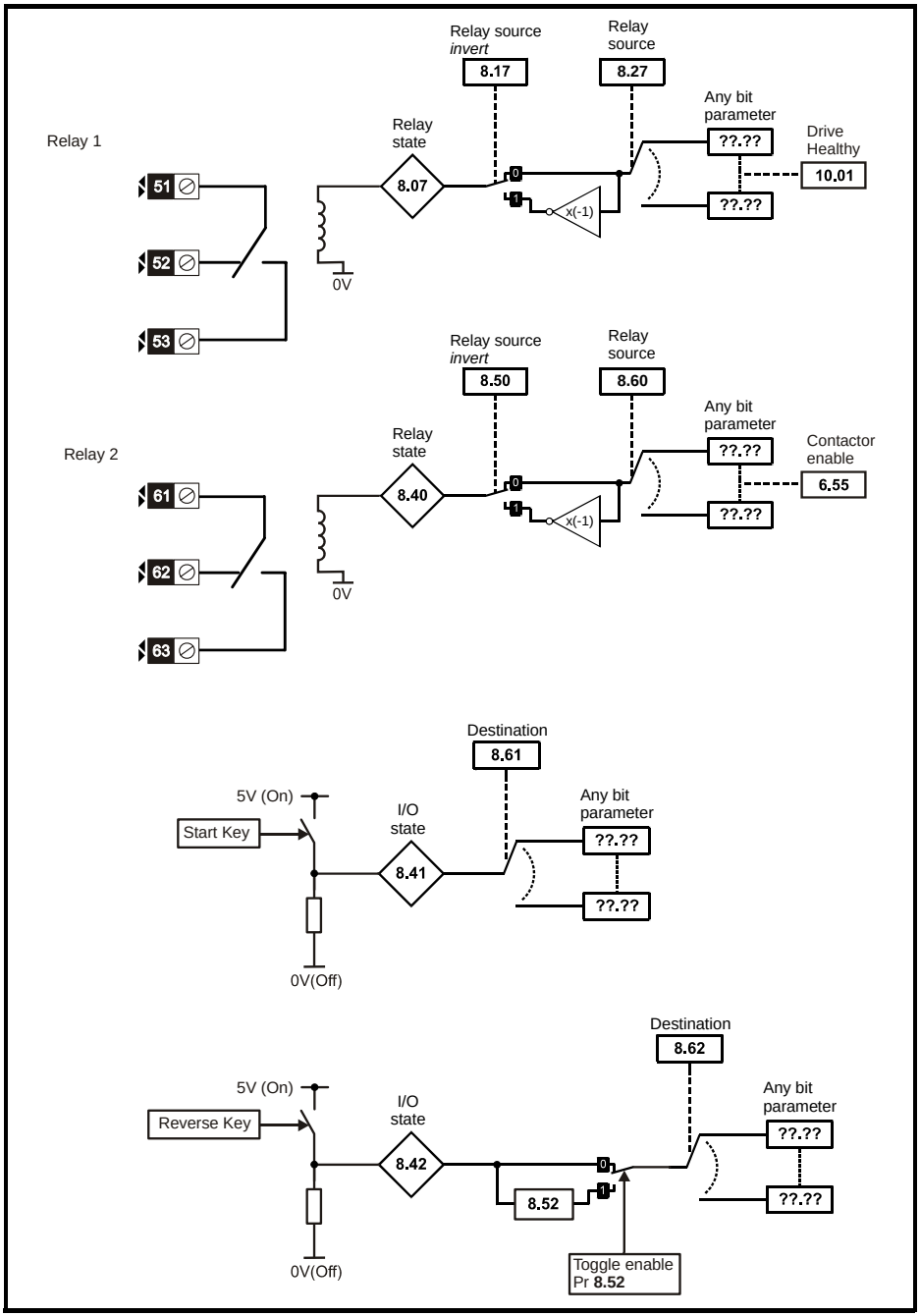
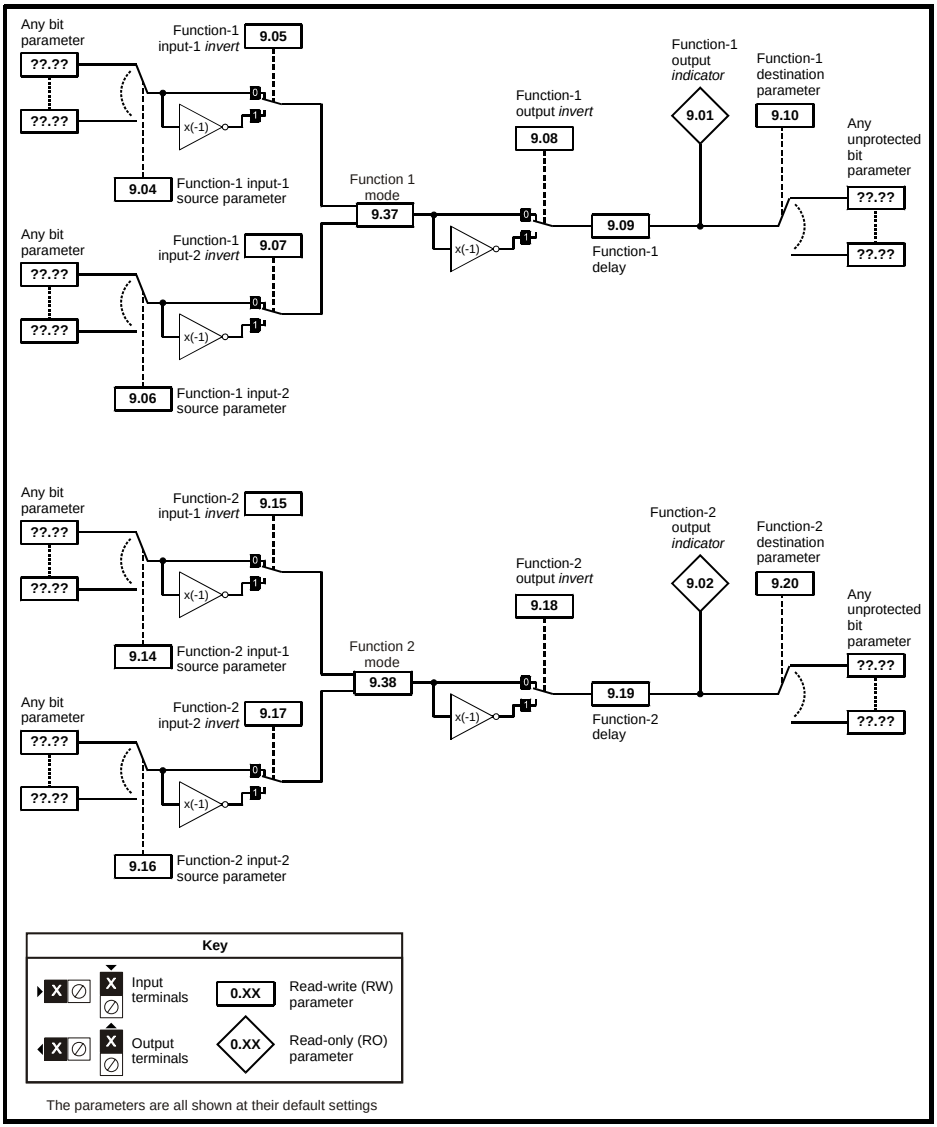


Figure 8-11 Menu 8 logic diagram (cont)



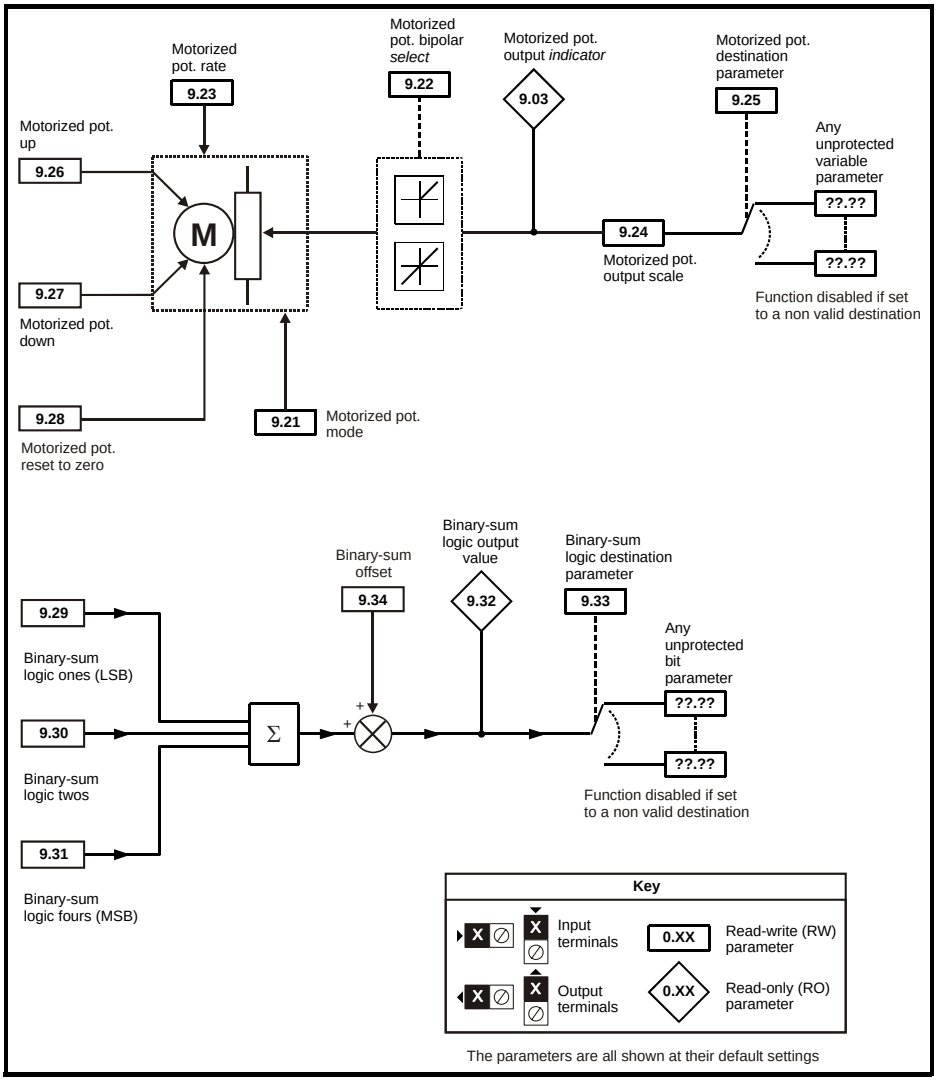
8.9 Menu 9: Programmable logic, motorized pot and binary sum

Figure 8-12 Menu 9 logic diagram: Programmable logic



The parameters are all shown at their default settings

Figure 8-13 Menu 9 logic diagram: Motorized potentiometer and binary sum



8.10 Menu 10: Status and trips

Parameter		
10.01	Drive ok	
10.02	Drive active	
10.03	Zero speed	
10.04	Running at or below minimum speed	
10.05	Below set speed	
10.06	At speed	
10.07	Above set speed	
10.08	Load reached	
10.09	Drive output is at current limit	
10.10	Regenerating	
10.13	Direction commanded	
10.14	Direction running	
10.17	Overload alarm	
10.18	Drive over temperature alarm	
10.19	Drive warning	
10.20	Trip 0	**tr01**
10.21	Trip 1	**tr02**
10.22	Trip 2	**tr03**
10.23	Trip 3	**tr04**
10.24	Trip 4	**tr05**
10.25	Trip 5	**tr06**
10.26	Trip 6	**tr07**
10.27	Trip 7	**tr08**
10.28	Trip 8	**tr09**
10.29	Trip 9	**tr10**
10.32	External trip	
10.33	Drive reset	
10.34	Number of auto-reset attempts	
10.35	Auto-reset delay	
10.36	Hold drive ok until last attempt	
10.38	User trip	
10.40	Status word	
10.41	Trip 0 time: years.days	
10.42	Trip 0 time: hours.minutes	
10.43	Trip 1 time	
10.44	Trip 2 time	
10.45	Trip 3 time	
10.46	Trip 4 time	
10.47	Trip 5 time	
10.48	Trip 6 time	
10.49	Trip 7 time	
10.50	Trip 8 time	
10.51	Trip 9 time	
10.52 to 10.61	Trip masks	
10.62 to 10.71	Stop on time masks	
10.72	Trip mask active	
10.73	Bridge active	
10.74	Electrical phase back	
10.75	Armature voltage clamp active	
10.76	Phase rotation	
10.77	Input frequency	

8.11 Menu 11: General drive set-up

Parameter		
11.21	Parameter scaling	
11.22	Parameter displayed at power-up	
11.23	Serial address	**Si02**
11.24	Serial mode	
11.25	Baud rate	**Si01**
11.26	Minimum comms transmit delay	
11.29	Software version	**di14**
11.30	User security code	
11.32	Current rating	
11.33	Drive voltage rating	
11.34	Software sub-version	
11.35	Number of modules	
11.36	SMARTCARD parameter data previously loaded	
11.37	SMARTCARD data number	
11.38	SMARTCARD data type / mode	
11.39	SMARTCARD data version	
11.40	SMARTCARD data checksum	
11.41	Status mode timeout	
11.42	Parameter copying	**SE09**
11.44	Security status	**SE14**
11.45	Select motor 2 parameters	
11.46	Defaults previously loaded	
11.47	Drive Onboard Application Lite Ladder Program Enable	
11.48	Drive Onboard Application Lite Ladder Program Status	
11.49	Drive Onboard Application Lite Ladder Program Events	
11.50	Drive Onboard Application Lite Ladder Program Maximum Scan Time	
11.51	Drive Onboard Application Lite Ladder Program First Run	
11.52	Drive serial number	
11.53	Build location	
11.55	Drive rating number	
11.56	Power PCB software version	
11.57	Serial programmable source	
11.58	Serial scaling	
11.59	Mentor II parameter emulator module control	
11.60	Application parameters	
11.61	Application parameters	
11.62	Full power discharge time	
11.63	Full power discharge period	
11.64	External discharge resistance	
11.65	External resistor temperature	
11.66	Suppressor voltage	

8.12 Menu 12: Threshold detectors, variable selectors and brake control function

Figure 8-14 Menu 12 logic diagram

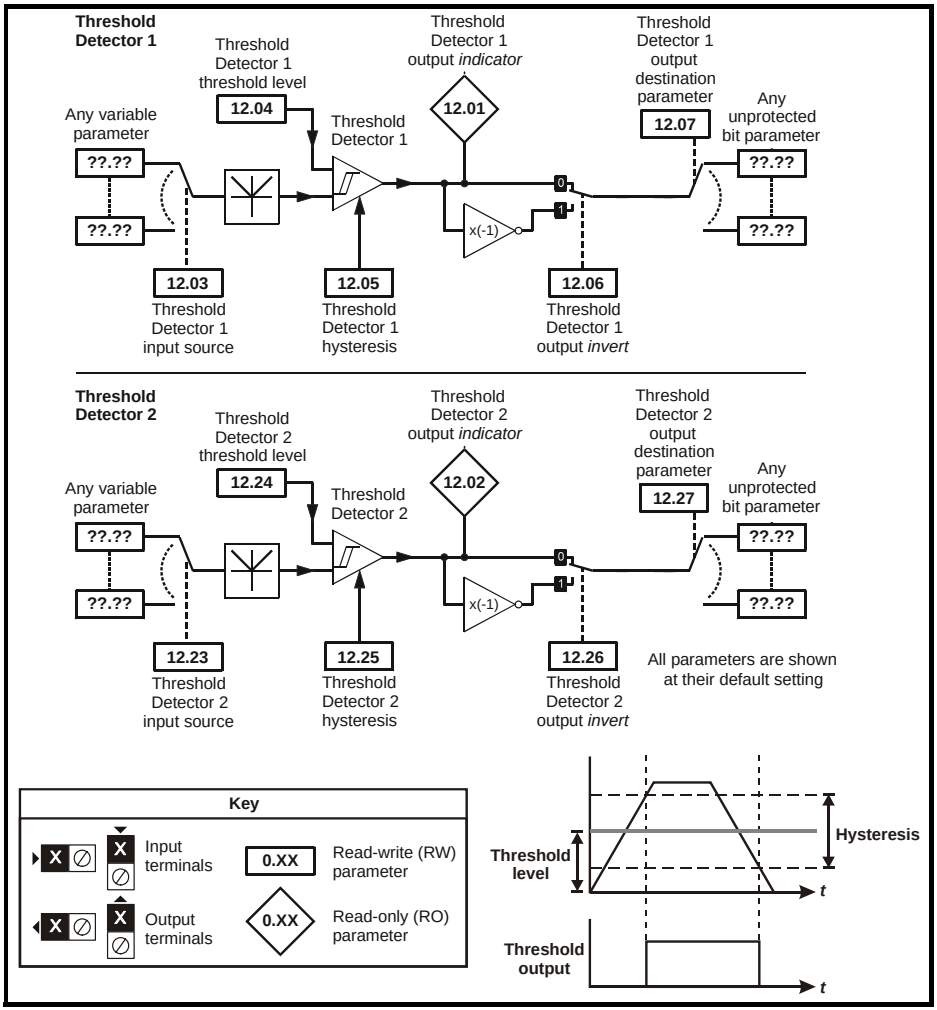


Figure 8-15 Menu 12 logic diagram (continued)

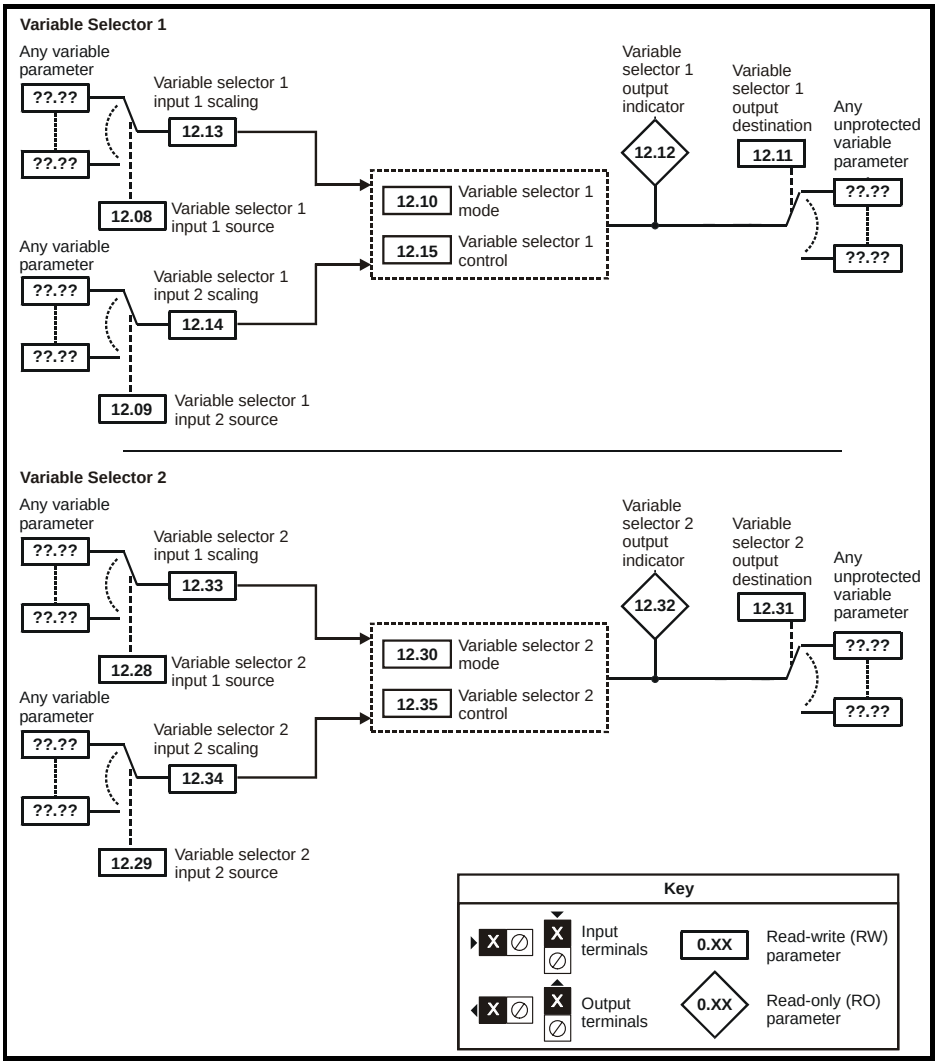


Figure 8-16 Menu 12 Brake control function

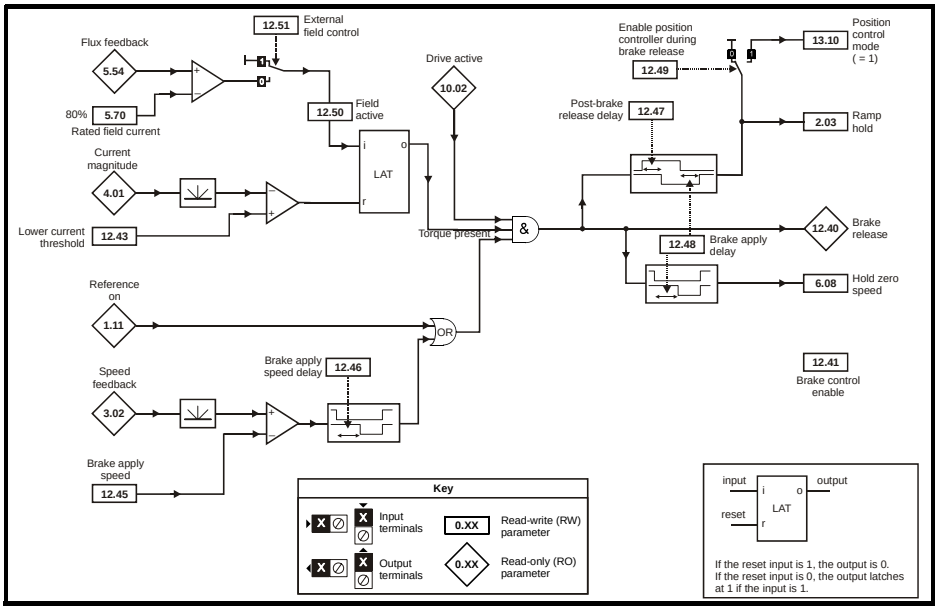
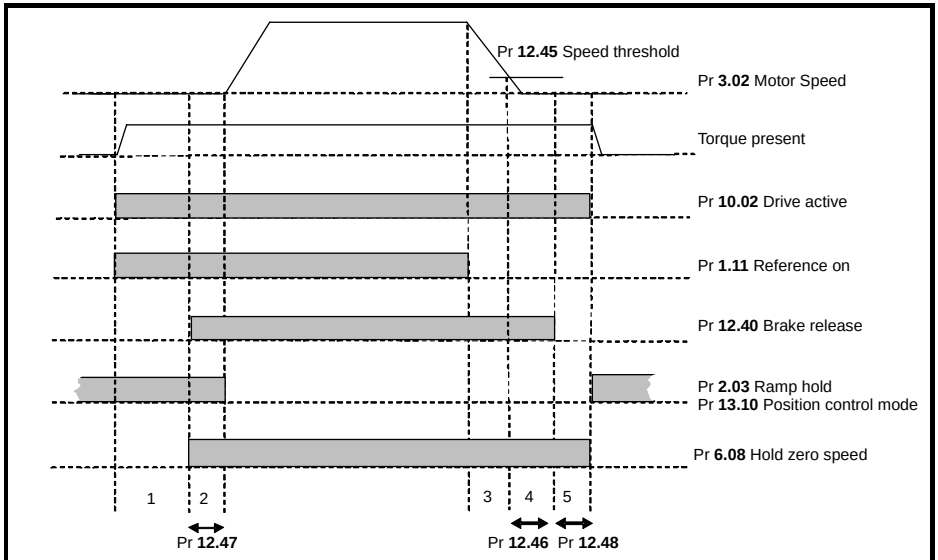


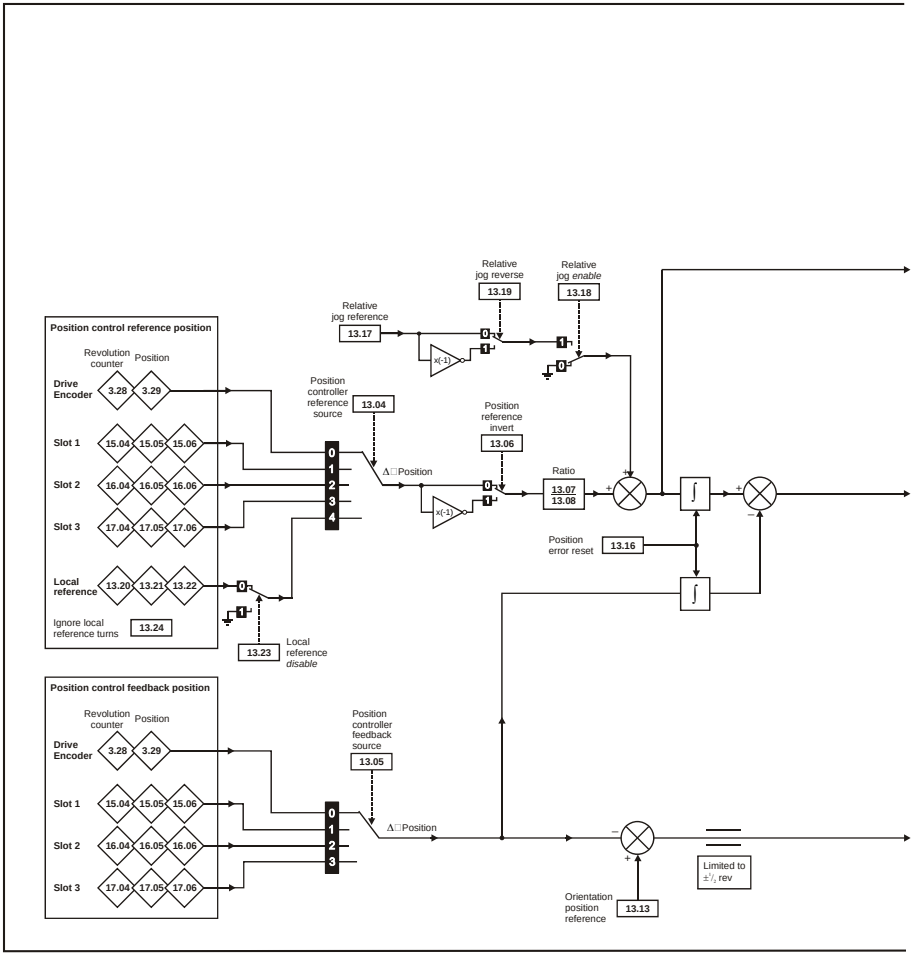
Figure 8-17 Brake sequence

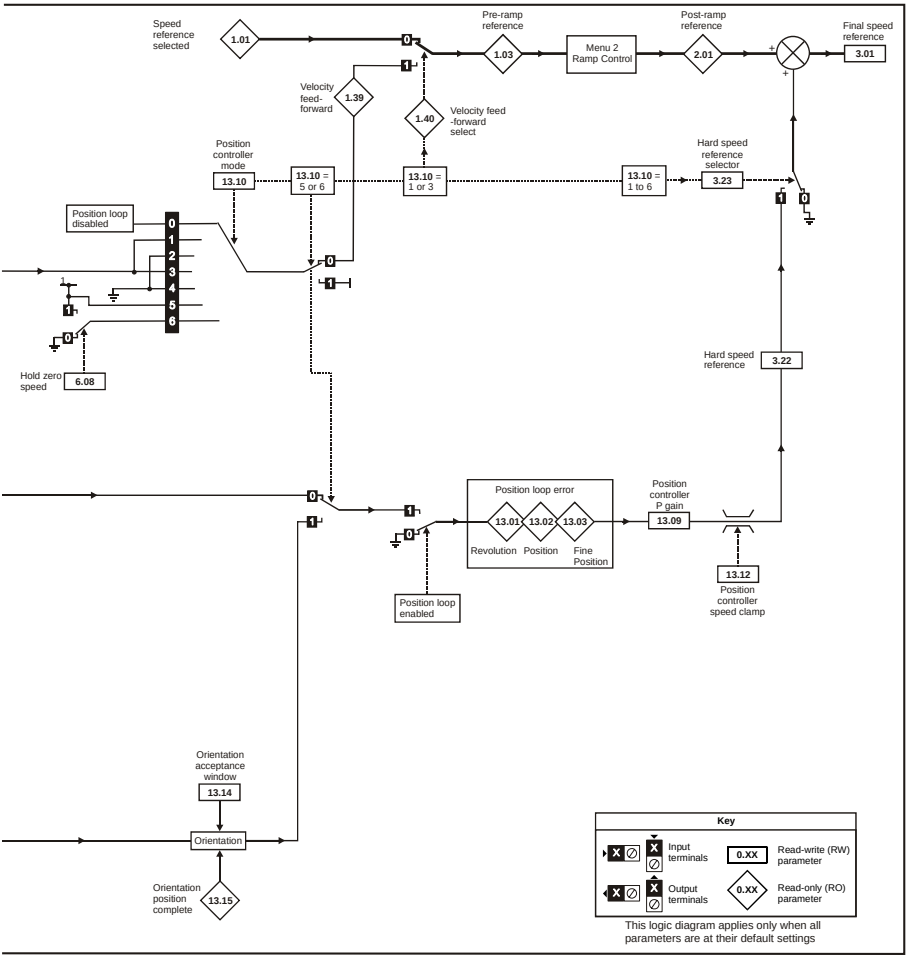


1. Wait for armature current and fully fluxed machine
2. Post-brake release delay
3. Wait for speed threshold
4. Wait for brake apply speed delay
5. Brake apply delay

8.13 Menu 13: Position control

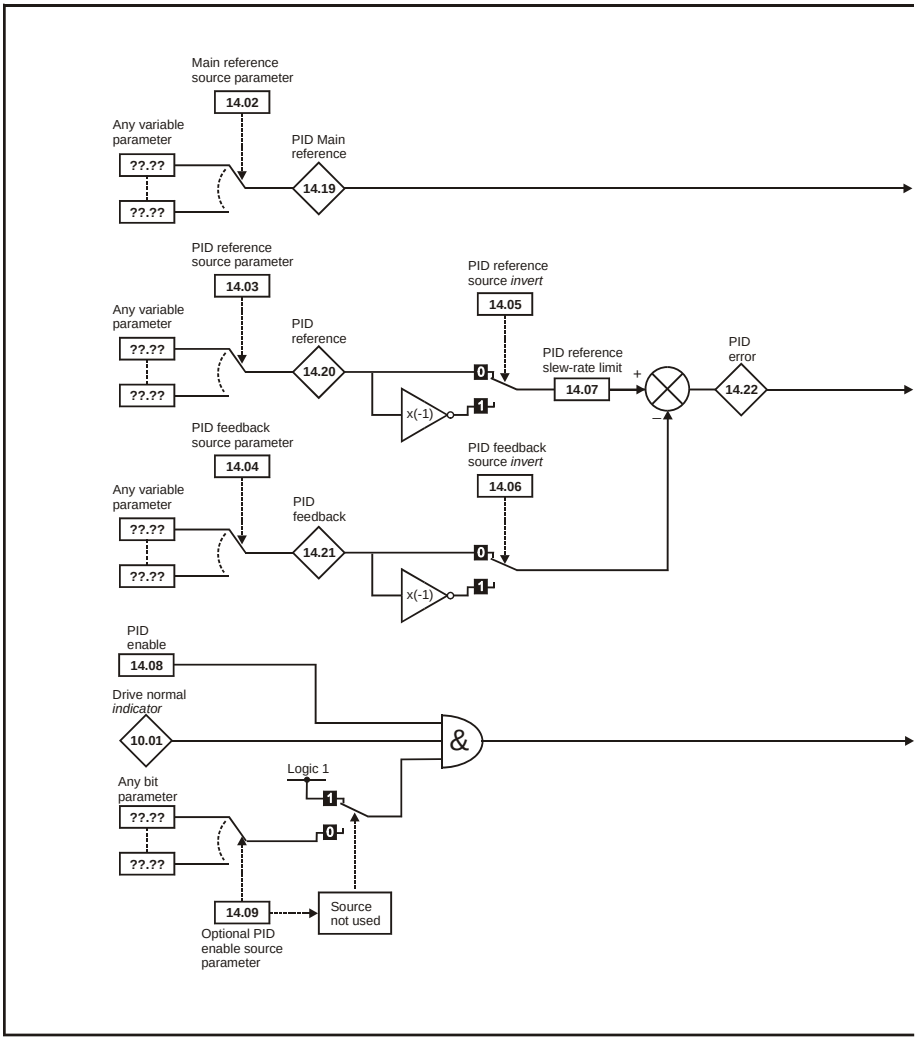
Figure 8-18 Menu 13 logic diagram

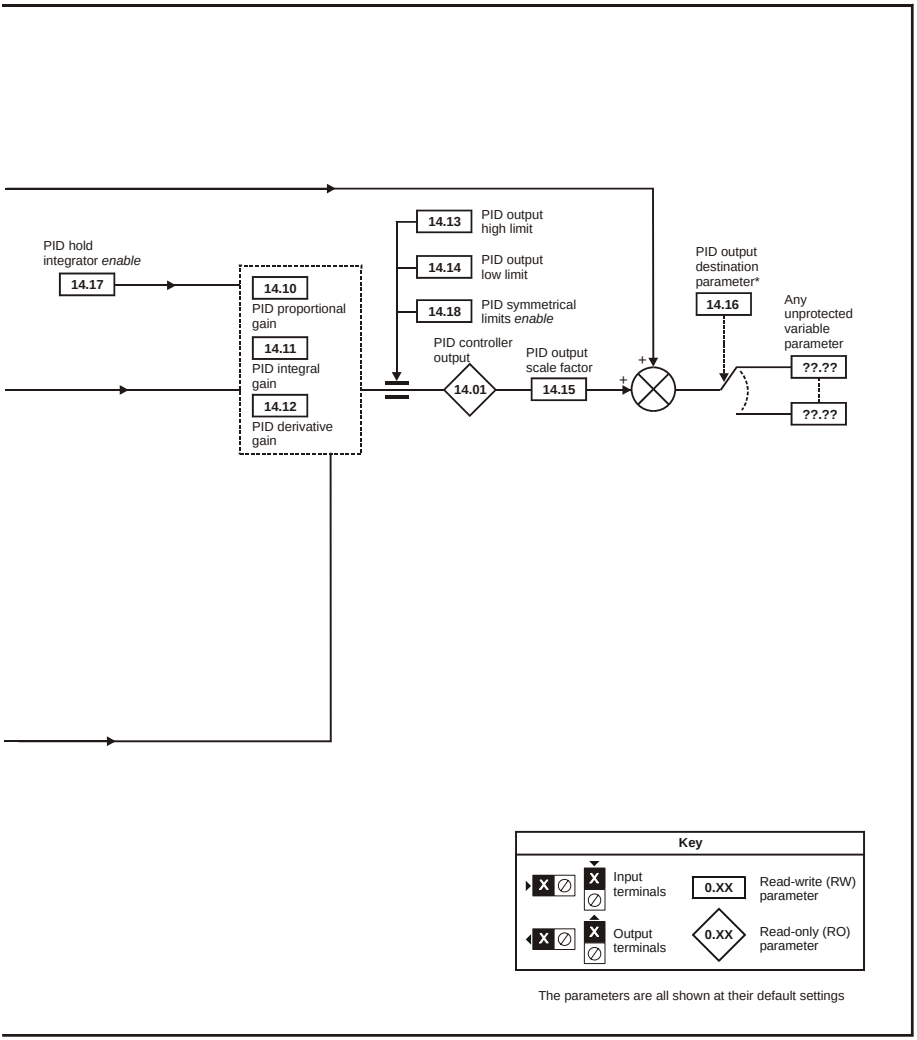



Speed reference selected
1.01
Pre-ramp reference
1.03
Menu 2 Ramp Control
Post-ramp reference
2.01
Final speed reference
3.01
Velocity feed-forward
1.39
1.40
Velocity feed -forward select
Position controller mode
13.10
13.10 = 5 or 6
13.10 = 1 or 3
13.10 = 1 to 6
Hard speed reference selector
3.23
Position loop disabled
Hold zero speed
6.08
Hard speed reference
3.22
Position loop error
13.01
13.02
13.03
Revolution
Position
Fine Position
Position controller P gain
13.09
Position controller speed clamp
13.12
Position loop enabled
Orientation acceptance window
13.14
Orientation
Orientation position complete
13.15
Key
Input terminals
Output terminals
Read-write (RW) parameter
Read-only (RO) parameter
0.XX
This logic diagram applies only when all parameters are at their default settings

8.14 Menu 14: User PID controller

Figure 8-19 Menu 14 logic diagram





*The PID controller is only enabled if Pr **14.16** is set to a non Pr **xx.00** and unprotected destination parameter.

8.15 Menus 15, 16 and 17: Solutions Module slots

Pr **x.00** and Pr **x.01** are always present in menus 15, 16 and 17. Pr **x.01** indicates which type of module is present (0 = no module installed). When a module is installed the drive provides the relevant menu (menu 15 for slot 1, 16 for slot 2 and 17 for slot 3) depending on the Solutions Module installed. The possible categories are shown below.

Solutions Module ID	Module	Category
0	No module installed	
102	SM-Universal Encoder Plus	Feedback
104	SM-Encoder Plus and SM-Encoder Output Plus	
201	SM-I/O Plus	Automation (I/O Expansion)
203	SM-I/O Timer	
204	SM-I/O PELV	
205	SM-I/O 24V Protected	
206	SM-I/O120V	
207	SM-I/O Lite	
208	SM-I/O 32	
304	SM-Applications Plus	Automation (Applications)
305	SM-Applications Lite V2	
306	SM-Register	
403	SM-PROFIBUS-DP-V1	Fieldbus
404	SM-INTERBUS	
407	SM-DeviceNet	
408	SM-CANopen	
410	SM-Ethernet	
421	SM-EtherCAT	

Refer to the specific *Solutions Module User Guide* for more information.

Parameters common to all categories

Parameter	
x.**01**	Solutions Module ID
x.**50**	Solutions Module error status

8.16 Menu 18, 19 & 20: Application menu 1, 2 & 3

Parameter	
18.01 (1) **19.01 (2)**	Power-down saved integer
18.02 to 18.10 (1) **19.02 to 19.10 (2)**	Read-only integer
18.11 to 18.30 (1) **19.11 to 19.30 (2)** **20.01 to 20.20 (3)**	Read-write integer
18.31 to 18.50 (1) **19.31 to 19.50 (2)**	Read-write bit
20.21 to 20.40 (3)	Read-write long integer

8.17 Menu 21: Second motor parameters

Parameter		Equivalent motor map 1 parameter
21.01	Maximum reference clamp	**1.06**
21.02	Minimum reference clamp	**1.07**
21.03	Reference selector	**1.14**
21.04	Acceleration rate	**2.11**
21.05	Deceleration rate	**2.21**
21.06	Base speed	**5.08**
21.07	Rated current	**5.07**
21.08	Back emf set point	**5.59**
21.09	Rated voltage	**5.09**
21.10	Armature resistance	**5.61**
21.11	Motor constant	**5.15**
21.12	Discontinuous current controller Ki gain	**4.34**
21.13	Continuous current controller Kp gain	**4.13**
21.14	Continuous current controller Ki gain	**4.14**
21.15	Motor 2 active	**11.45**
21.16	Thermal time constant	**4.15**
21.17	Speed controller Kp gain	**3.10**
21.18	Speed controller Ki gain	**3.11**
21.19	Speed controller Kd gain	**3.12**
21.21	Speed feedback selector	**3.26**
21.23	Rated field voltage	**5.73**
21.24	Rated field current	**5.70**
21.25	Motor saturation breakpoint 1	**5.29**
21.26	Motor saturation breakpoint 2	**5.30**
21.27	Motoring current limit	**4.05**
21.28	Regen current limit	**4.06**
21.29	Symmetrical current limit	**4.07**
21.30	Field thermal time constant	**5.81**
21.31	Flux loop P gain	**5.71**
21.32	Flux loop I gain	**5.72**
21.33	field weakening P gain	**5.62**
21.34	field weakening I gain	**5.63**
21.35	Rated field compensation factor	**5.74**

8.18 Menu 22: Additional Menu 0 set-up

Parameter	
22.01	Pr **0.01** set-up
22.02	Pr **0.02** set-up
22.03	Pr **0.03** set-up
22.04	Pr **0.04** set-up
22.05	Pr **0.05** set-up
22.06	Pr **0.06** set-up
22.07	Pr **0.07** set-up
22.08	Pr **0.08** set-up
22.09	Pr **0.09** set-up
22.10	Pr **0.10** set-up
22.11	Pr **0.11** set-up
22.12	Pr **0.12** set-up
22.13	Pr **0.13** set-up
22.14	Pr **0.14** set-up
22.15	Pr **0.15** set-up
22.16	Pr **0.16** set-up
22.17	Pr **0.17** set-up
22.18	Pr **0.18** set-up
22.19	Pr **0.19** set-up
22.20	Pr **0.20** set-up

8.19 Menu 23: Header selections

Parameter	
23.01	Sub block headers
23.02	Binary sum of pre-defined sub block enables
23.03	SEt UP
23.04	diAGnoS
23.05	triPS
23.06	SP LOOP
23.07	SintEr
23.08	Fb SP
23.09	InPut

9 Diagnostics

9.1 Trip indications

Users must not attempt to repair a drive if it is faulty, nor carry out fault diagnosis other than through the use of the diagnostic features described in this chapter.
If a drive is faulty, it must be returned to an authorized LEROY-SOMER distributor for repair.

Table 9-1 Trip indications

Trip	Number	Description
AOC	**3**	Instantaneous output over current detected: peak output current greater than 225%
AOP	**158**	Voltage has been applied to the armature but no current feedback has been detected
C.Acc	**185**	SMARTCARD trip: SMARTCARD read/write fail
C.Boot	**177**	SMARTCARD trip: Menu 0 parameter modification cannot be saved to the SMARTCARD because the necessary file has not been created on the SMARTCARD
C.BUSy	**178**	SMARTCARD trip: SMARTCARD can not perform the required function as it is being accessed by a Solutions Module
C.Chg	**179**	SMARTCARD trip: Data location already contains data
C.cpr	**188**	SMARTCARD trip: values stored in the drive and the values in the data block on the SMARTCARD are different
C.dat	**183**	SMARTCARD trip: data location specified does not contain any data
C.Err	**182**	SMARTCARD trip: SMARTCARD data is corrupted
C.FULL	**184**	SMARTCARD trip: SMARTCARD full
cL2	**28**	Analog input 2 current loss (current mode)
cL3	**29**	Analog input 3 current loss (current mode)
CL.bit	**35**	Trip initiated from the control word (Pr **6.42**)
C.Optn	**180**	SMARTCARD trip: Solutions Modules installed are different between source drive and destination drive
C.Prod	**175**	SMARTCARD is not compatible with this drive
C.RdO	**181**	SMARTCARD trip: SMARTCARD has the read-only bit set
C.rtg	**186**	SMARTCARD trip: the voltage and/or the current rating of the source and the destination drives are different
C.Typ	**187**	SMARTCARD trip: SMARTCARD parameter set not compatible with drive
dESt	**199**	Two or more parameters are writing to the same destination parameter
EEF	**31**	EEPROM data corrupted: drive mode becomes open loop and serial comms will timeout with remote keypad on the drive RS485 comms port.
EnC1	**189**	Drive encoder trip: encoder power supply overload
EnC2	**190**	Drive encoder trip: wire break
EnC3	**191**	Drive encoder trip: overload
EnC9	**197**	Drive encoder trip: position feedback is selected from a Solutions Module slot which does not have a speed/position feedback Solutions Module installed
EnC10	**198**	Drive encoder trip: termination overload
Et	**6**	External trip from input on terminal 31
FbL	**159**	No signal from the tachogenerator or encoder
Fbr	**160**	The polarity of the feedback tachogenerator or encoder is incorrect

Trip	Number	Description
FdL	**168**	No current in the field supply circuit.
FOC	**169**	Excess current detected in field current feedback. If maximum current feedback is present when the firing angle is fully phased back then trip
F.OVL	**157**	Field I^2t overload
HFxx	**217 to 229**	Hardware fault - return drive to supplier (see the *Mentor MP User Guide* for further information)
It.AC	**20**	I^2t on drive output current (refer to Pr **4.16**)
O.Ld1	**26**	Digital output overload: total current drawn from digital outputs exceeds 200mA
O.ht1	**21**	Drive overheat (thyristor junction) based on thermal model
O.ht2	**22**	Heatsink over-temperature
O.ht3	**27**	External discharge resistor over-temperature
O.SPd	**7**	Motor speed has exceeded the over speed threshold
Pad	**34**	Keypad has been removed when the drive is receiving the speed reference from the keypad
PLL Err	**174**	Phase Lock Loop cannot lock to the auxiliary supply
PS	**5**	Internal power supply fault
PS.10V	**8**	10V user power supply current greater than 10mA
PS.24V	**9**	24V user power supply current greater than 200mA
PSAVE.Er	**37**	Power down save parameters in the EEPROM are corrupt
SAVE.Er	**36**	User save parameters in the EEPROM are corrupt
SCL	**30**	Drive RS485 serial comms loss to remote keypad
SL	**170**	One or more of the power supply phases is open circuit
S.Old	**171**	The maximum power the over voltage suppressor can handle has been exceeded
S.OV	**172**	Excessive suppressor voltage
SL.rtd	**215**	Solutions Module trip: drive mode has changed and Solutions Module parameter routing is now incorrect
SL1.dF	**204**	Solutions Module slot 1 trip: Solutions Module type installed in slot 1 changed
SL1.Er	**202**	Solutions Module slot 1 trip: Solutions Module in slot 1 has detected a fault
SL1.HF	**200**	Solutions Module in slot 1: error. The module has detected an error and tripped the drive. The reason for the error is stored in Pr **xx.50**.
SL1.nF	**203**	Solutions Module slot 1 trip: Solutions Module has been removed
SL1.tO	**201**	Solutions Module slot 1 trip: Solutions Module watchdog timeout
SL2.dF	**209**	Solutions Module slot 2 trip: Solutions Module type installed in slot 2 changed
SL2.Er	**207**	Solutions Module slot 2 trip: Solutions Module in slot 2 has detected a fault
SL2.HF	**205**	Solutions Module slot 2 trip: hardware fault
SL2.nF	**208**	Solutions Module slot 2 trip: Solutions Module has been removed
SL2.tO	**206**	Solutions Module slot 2 trip: Solutions Module watchdog timeout
SL3.dF	**214**	Solutions Module slot 3 trip: Solutions Module type installed in slot 3 changed
SL3.Er	**212**	Solutions Module slot 3 trip: Solutions Module in slot 3 has detected a fault
SL3.HF	**210**	Solutions Module in slot 3: hardware fault
SL3.nF	**213**	Solutions Module slot 3 trip: Solutions Module has been removed
SL3.tO	**211**	Solutions Module slot 3 trip: Solutions Module watchdog timeout
t002	**2**	Reserved
t004	**4**	Reserved
t010	**10**	Reserved
t019	**19**	Reserved

Trip	Number	Description
t023	23	User trip
t032	32	Reserved
t033	33	Reserved
t038 to t039	38 to 39	Reserved
t040 to t089	40 to 89	User trips
t099	99	User trip defined in 2nd processor Solutions Module code
t101	101	User trip
t102 to t111	102 to 111	Reserved
t112 to t156	112 to 156	User trip
t161 to t167	161 to 167	Reserved
t176	176	Reserved
t192	192	Reserved
t193	193	Reserved
t194	194	Reserved
t195	195	Reserved
t196	196	Reserved
t216	216	User trip
th	24	Motor thermistor trip
th.Err	173	Thyristor missing
thS	25	Motor thermistor short circuit
tunE	18	Autotune stopped before completion
tunE1	11	The position feedback did not change or required speed could not be reached during the inertia test (refer to Pr **5.12 (SE13, 0.34**))
tunE2	12	Position feedback direction incorrect or motor could not be stopped during the inertia test (refer to Pr **5.12 (SE13, 0.34**))
tunE3	13	Field flux has not decayed to zero during autotune
tunE4	14	Back emf detected during autotune
tunE5	15	No field current detected during autotune
tunE6	16	Cannot achieve ¼ rated back emf during autotune. Reset Pr **5.70** (**SE10, 0.31**) to name plate value and re- autotune motor
tunE7	17	Rotating autotune requested when using estimated speed feedback
UP ACC	98	Onboard PLC program: cannot access Onboard PLC program file on drive
UP div0	90	Onboard PLC program attempted divide by zero
UP OFL	95	Onboard PLC program variables and function block calls using more than the allowed RAM space (stack overflow)
UP ovr	94	Onboard PLC program attempted out of range parameter write
UP Par	91	Onboard PLC program attempted access to a non-existent parameter
UP ro	92	Onboard PLC program attempted write to a read-only parameter
UP So	93	Onboard PLC program attempted read of a write-only parameter
UP udF	97	Onboard PLC program undefined trip
UP uSEr	96	Onboard PLC program requested a trip
UV	1	Running from external +24V

9.2 Alarm indications

In any mode an alarm flashes alternately with the data displayed on the 2nd row when one of the following conditions occur. If action is not taken to eliminate any alarm except "Autotune", and "PLC" the drive may eventually trip. Alarms flash once every 640ms except "PLC" which flashes once every 10s. Alarms are not displayed when a parameter is being edited.

Table 9-2 Alarm indications

Lower display	Description
Hot	Heatsink alarm is active
The temperature displayed in Pr **7.04** has exceeded the alarm level (see Pr **7.04**).	
OVLd	Motor overload
The motor I^2t accumulator (Pr **4.19**) in the drive has reached 75% of the value at which the drive will be tripped and the load on the drive is > motor rated current Pr **5.07** (**SE07, 0.28**)	
Autotune	Autotune in progress
The autotune procedure has been initialised. 'Auto' and 'tunE' will flash alternatively on the display.	
CLt	Current limit is active
Indicates that current limits are active.	
PLC	Onboard PLC program is running
An Onboard PLC program is installed and running. The lower display will flash 'PLC' once every 10s.	
S.OV	Indicated suppressor over voltage
Indicates that the over voltage suppressor voltage is within 30V of the trip level	
S.rS	Suppressor resistor overload
Indicates that the external voltage suppressor resistor is in an overload condition	
ESt SPd	Estimated speed selected
The drive has lost speed feedback and automatically selected Estimated speed mode. See Pr **3.55** (Select estimated speed on feedback loss).	

9.3 Status indications

Table 9-3 Status indications

Upper display	Description	Drive output stage
dEC	Decelerating	Enabled
Speed is ramping to zero after a stop		
inh	Inhibited	Disabled
Enable input is inactive		
POS	Position	Enabled
Position control active during orientation stop		
rdY	Ready	Disabled
Enable closed, but drive not active		
run	Running	Enabled
Drive active and motor running		
StoP	Stopped	Enabled
Drive active, but holding zero speed.		
triP	Tripped	Disabled
Drive is tripped.		

9.4 Trip masking

Drive trips can be masked by setting the appropriate trip code in Pr **10.52** to Pr **10.61**. Refer to Pr **10.52** to Pr **10.72** (Advanced parameter descriptions chapter - Menu 10) in the *Mentor MP Advanced User Guide* for further information.

10 UL listing

Mentor MP frame size 1 drives have been assessed to comply with both ULus and cUL requirements.

LEROY-SOMER UL file number is E171230. Confirmation of UL listing can be found at website: www.ul.com

10.1 Common UL Information

Conformity: The drive conforms to UL listing requirements only when the following are observed:

1. The drive is installed in a type 1 enclosure, or better as defined in UL 50.
2. The ambient temperature does not exceed 40°C when the drive is operating.
3. The terminal torques specified in the *Mentor MP User Guide* are to be used.
4. The power terminal lug used to crimp the, I/P & O/P cables are to be UL listed.
5. The drive is to be installed in to a pollution degree 2 environment.
6. If the drive control stage is supplied by an external power supply, (+24V), the external power supply must be a UL class 2 power supply.
7. Fuses sized as specified in the various tables in section 4.6 *Cable and fuse size ratings* on page 38 are to be used. Fusing is to incorporate a Class J fuse in line with a semiconductor fuse as specified.
8. Field wiring is to be class 1 75°C (167°F) copper wire only.

Motor overload protection

All models incorporate an internal overload protection model for the motor load that does not require the use of an external or remote overload protection device.

The protection level is adjustable, and the method of adjustment is provided with the instructions for the product.

Maximum current overload is dependant on the values entered into the current limit parameters (motoring current limit, regen current limit and symmetrical current limit entered as percentage) and the motor rated current parameter (entered in amperes).

The duration of the overload is dependant on motor thermal time constant (variable up to a maximum of 3000 seconds). The default overload protection is set such that the product is capable of 150% of the current value entered into the motor rated current parameter (Pr **5.07** (**SE07**, **0.28**)) for 30 seconds (20 seconds for MP470A4(R), MP470A5(R), MP825A5(R) and MP825A6(R). The product also provides user terminal default functionality such that the product can be connected to a motor thermistor to protect the motor in terms of temperature, in the event of a motor cooling fan failure.

Over speed protection

The drive provides overspeed protection. However it does not provide the level of protection afforded by an independent high integrity overspeed protection device.

10.2 AC supply specification

The maximum UL supply voltage is 600Vac.

The drive is suitable for use in a circuit capable of delivering not more than 100,000rms symmetrical Amperes at 575V (size 1A and 1B).

Maximum continuous output current

The drive models are listed as having the maximum continuous output currents (FLC) shown in section 2.2 *Current ratings* on page 9.

10.3 Safety label

The safety label supplied with connectors and mounting brackets must be placed on a fixed part of the drive enclosure where it can be seen clearly by maintenance personnel for UL compliance.

The label clearly states "CAUTION risk of electric shock power down at least 10 minutes before removing cover".

10.4 UL Listed accessories

- SM-Keypad
- SM-DeviceNet
- SM-INTERBUS
- SM-Ethernet
- SM-Register
- SM-Applications Plus
- SM-Encoder Plus
- SM-I/O Plus
- SM-I/O Lite
- SM-I/O PELV
- SM-I/O 24V Protected
- Single ended encoder interface
- MP-Keypad
- SM-PROFIBUS-DP-V1
- SM-CANopen
- SM-EtherCAT
- SM-Applications Lite-V2
- SM-Universal Encoder Plus
- SM-Encoder Output Plus
- SM-I/O 32
- SM-I/O Timer
- SM-I/O 120V
- 15-way D-type converter

Note

Note

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338 567 258 RCS ANGOULÊME
S.A. au capital de 62 779 000 €

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